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COD LIVER OIL THERAPY OF WOUNDS AND BURNS

PARKER C. HARDIN, M. D., F. A. C. S.
Monroe, N. C.

INTRODUCED by Lohr[1] in 1934, the local use of cod liver oil as a wound dressing, applied alone or in ointment form, is now widely accepted by European clinicians as a therapeutic procedure of proven worth. Based on extensive experimental and clinical studies, over one hundred foreign publications attest the admirable results secured with this method in the treatment of burns and both clean and infected wounds of many types. Within recent years approximately twenty-five papers have appeared in the American literature. But the cod liver oil method has attracted comparatively little attention in this country.

For over five years I have employed cod liver oil as a wound dressing in an increasing variety of surgical conditions. The results have been so generally gratifying that the method would seem to merit wider recognition by American surgeons. Experiences with a small group of cases have been previously reported[2]. Observations on the cod liver oil treatment of 346 cases of assorted wounds and burns at the Ellen Fitzgerald Hospital form the basis for the present paper.

REVIEW OF THE LITERATURE

In numerous reports Lohr[3-12] has recorded unusual success in treating several thousand cases of burns, ulcers, osteomyelitis, various clean and infected wounds, and pyogenic skin infections using an ointment of crude cod liver oil and petrolatum (unguentolan) and plaster casts. Lohr's claims were soon widely confirmed abroad. Steel[13] treated burns and wounds with crude cod liver oil dressings and was so impressed with the rapid healing and almost total elimination of scar tissue that he gave up tannic acid for burns and used the oil routinely. Tennent[14], Zuelzer[15], Zoltan[16], Horn and Sandor[17],

From the Ellen Fitzgerald Hospital.
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Sandor[18], Lauber and Rocholl[19], Seiring[20], Strauss[21], Ritter[22], Daver[23], Chatterjee[24], Herlyn[25], Jencio[26], and other early investigators have extolled the cod liver oil method for wounds and burns. Stevenson[27] showed that the oil is ideal for burns of the cornea, eye, and lids. Hare[28] acclaimed it for scalds, and Durand[29] for frostbites. Wartmann[30], and Borovskaya[31] reported its successful use in certain dermatologic conditions. Though Lucke[32] and Buchheister[33] preferred the oil mixed with honey, most of these authors used an ointment of cod liver oil and petrolatum, while others employed the oil alone, with or without casts.

In this country the external use of cod liver oil has been favorably reviewed in a comprehensive article by Holmes[34]. Puestow, Poncher, and Hammatt[35] performed controlled experiments proving that burns in pigs and rabbits healed 25 per cent faster under cod liver oil than with tannic acid. Berlien and Davis[36] enthusiastically recommended 60 per cent cod liver oil-vaseline ointment and plaster bandages for major burns. Meherin and Schomaker[37] praised the oil for cement burns. Kazanjian[38], Aldrich[39], and MacCollum[40] advised its use for indolent granulations. Wright[41] reported success in treating osteomyelitis and compound fractures with cod liver oil and zinc peroxide. Salzman and Goldstein[42] obtained rapid healing of suppurative cutaneous wounds and ulcerations with "Codalltoin," an ointment containing 45 per cent cod liver oil and 2 per cent allantoin. Driver, Binkley, and Sullivan[43] secured superlative results in 25 cases of indolent ulcers treated with an ointment of 88 per cent cod liver oil and 12 per cent white wax. Banyai[44], reporting successful local application of cod liver oil in tuberculous laryngeal ulcers, noted healing of the ulcers and recovery from pulmonary tuberculosis in a notably high percentage of cases. Brandaleone[45] treated chronic diabetic ulcers of the feet with topically applied cod liver oil. Early healing occurred in all but one of 21 treated cases, resulting from rapid increase of epithelial tissue. Infection was reduced and results in the cod liver oil treated cases were markedly superior to those in the controls.

Advantages of Cod Liver Oil as a Wound Dressing.

Certain properties impart to cod liver oil a unique effectiveness as a wound dressing. The oil is sterile and bactericidal. Lohr[46] found that it readily destroys staphylococci, streptococci, B. coli, and even tubercle bacilli. Tumanskiy and Jacevitch[47] showed that streptococci and staphylococci cease growing in unsterilized cod liver oil in one hour and six hours respectively, whereas these same organisms grow for fifteen days in sterile petrolatum. Iost and Kochergin[48] proved that the oil lowers the vitality of pyogenic bacteria. Lich-

tenstein[49] demonstrated its bactericidal effect experimentally. Drigalski[50] showed that it inhibits the growth of gas and spore-forming organisms.

Of primary importance is its stimulating effect on granulations and epithelization. This results in a remarkable regeneration of all sorts of tissue defects. Its influence is at times dramatic. Wounds fill more quickly with granulations, epithelize more satisfactorily, and heal more rapidly than with other methods. It is particularly effective in unhealthy wounds which have not progressed under previous therapy. Old infected third degree burns, varicose, decubitus, or other long-standing ulcers, and chronically infected wounds may be transformed quickly into renewed activity and heal with surprising rapidity.

The oil produces not merely a local response but also a beneficial generalized systemic effect. In a large series of controlled experiments on the healing of tuberculous ulcers in guinea pigs, Getz[51] showed that not only did the ulcers in the cod liver oil treated animals always heal faster, and with remarkably little scarring, but the treated pigs showed less generalized tuberculosis than did the controls. Tuna and halibut liver oils produced no favorable systemic effect. Similar tests proved paraffine, lanum, olive, and cottonseed oils to be ineffective.

Cod liver oil dressings accelerate the liquefaction of dead tissue in the presence of pus and markedly reduce the toxicity of pus, as proved in animal experiments by Kummel and Jensen[52]. The surface of the wound is cleared; the medium on which bacteria thrive is thus removed, with obvious benefit in the case of burns and infected wounds. Traxl[53] also showed that the oil increases the metabolic rate of leukocytes by 420 per cent.

The oil forms a protective non-irritating layer over the wound, as emphasized by Lohr[3-12], and Schaer[54], guarding it from injury when dressings are changed. Separation occurs between the oily layers and not between the wound surface and the gauze which is so often found adherent with other dressings. Similarly, I have observed that the tendency of granulations to bleed excessively in changing dressings is minimized by the use of cod liver oil. Loss of much-needed blood is thus prevented in chronic cases such as extensive burn ulcerations so often associated with severe anemia. These benefits are augmented by the employment of plaster or infrequent dressings.

The oil dressings are painless and eliminate the agony associated with dressing these terrible wounds. The patient's apprehension disappears; general improvement results.

Lastly, cod liver oil dressings produce minimal scarring as proved experimentally and confirmed by countless clinical observations including my own.

The Role of Vitamins in the Cod Liver Oil Effect.

The explanation of the local stimulating effect of cod liver oil on granulations and epithelization as due to the vitamin A and D content of the oil is now generally accepted. It has long been recognized that vitamin A administered orally exerts a protective and stimulating regenerative effect on epithelium. More recently it has been shown that adequate amounts of oral vitamin C are essential for wound healing. Lauber[55], and Lundh[56] proved conclusively "that vitamins A and D were absorbed through the surface of the wound into general circulation and then exerted a beneficial action on the whole organism." Lauber[57] cites extensive experiments indicating that vitamins A and D have a local growth-promoting and stimulating action on connective tissue and epithelial cells. The experiments of Drigalski[58] indicated that cod liver oil ointment hastens healing in skin wounds of guinea pigs more rapidly than vitamin-free ointments; he thought this was due to vitamin A. Proto[59], studying the action of vitamins on the healing of wounds in rabbits, concluded that the healing process is not modified by local administration of vitamin C, that it is slightly modified by vitamins A and D given orally, but that "it is greatly and favorably modified by local application of these vitamins to the wounds, especially A. The time of healing is greatly lessened, and the condition of the wounds is much better than in the controls." Lohr and Treusch[46], and Hayashi[60] also believe the vitamin A and D content of the oil are both important. Independently, both Lohr and Unger[61], and Getz[51] showed that the active stimulating agent is concentrated in the non-saponifiable fraction of cod liver oil which contains vitamins A and D, also iodine and numerous unknown substances. Getz[51] showed that it is not alone vitamin A nor vitamin D but the combination of both present in the proportion found in cod liver oil which is responsible for the stimulating effect. This explains why Dykes[62], Puestow[36], and others have found cod liver oil definitely superior to halibut and other fish liver oils in the treatment of wounds, since these oils contain vitamins A and D in proportions differing from those in cod liver oil. McLaughlin[63] sums up the matter well in stating that vitamin A appears essential for the growth of epithelial cells; that vitamin D is probably not essential and not sufficient to support epithelial growth by itself; but that vitamin D is a powerful stimulant to cell growth in the presence of vitamin A.

Indications

The cod liver oil method is not merely the employment of a supposedly magical oil as a wound dressing. It is rather, in my hands, a complete plan whereby all possible tissue is preserved, infection minimized, granulation stimulated, and healing accelerated by the physiologic principles of closed antiseptic dressing, rest, and avoidance of disturbance of granulations.

I have found cod liver oil therapy especially applicable to extensive crushing or destructive injuries—where more tissue can be preserved—and to compound fractures, gunshot wounds, open amputation stumps, abscess cavities, large infected wounds, major primary burns, and extensive ulcerations from deep third degree burns or other causes; in short, to any injury with loss of tissue in which immediate surgical closure is not feasible.

Types of Cases in Series of 346 Wounds and Burns Treated with Cod Liver Oil.

This series of 346 wounds and burns treated with cod liver oil is summarized in table 1.

Table 1

22	primary major burns
1	deep destructive multiple electrical burn
39	minor burns
26	amputation stumps: 2 femur, 4 tibia and fibula, 2 humerus, 2 radius and ulna, 5 metacarpal or metatarsal, 11 phalanx
19	compound fractures: 1 tibia, 1 fibula, 1 os calcis, 1 ilium, 5 metacarpal or metatarsal, 10 phalanx
1	extensive multiple compound fracture of skull
16	very large ulcerating areas: 5 old burns, 3 chronic undermining burrowing ulcers, 8 extensive decubitus and miscellaneous ulcers
2	ruptured infected eviscerating abdominal wounds
18	deep wounds: penetrating, gunshot, postoperative, or abscess cavity
20	draining or infected abdominal wounds
12	varicose or chronic leg ulcers
3	acute osteomyelitis: 1 tibia, 2 phalanx
3	chronic osteomyelitis: 1 metatarsal, 2 phalanx
1	severe avulsion of entire skin of penis (to be reported)
84	assorted clean open wounds
79	assorted infected wounds and abscesses
346	Total Cases.

Cod Liver Oil Treatment of Wounds

Thus in clean fresh cases the surrounding parts and then the wound itself are thoroughly cleansed by sterile soap and water scrubbing for at least ten minutes. No antiseptic is employed in the wound. Scrupulous but conservative debridement is carried out.

All viable tissue is saved. Compound fractures are reduced if present. Plastic repair is accomplished where possible. Suture is done wherever indicated. The remaining open wound is then filled with cod liver oil ointment applied on gauze to all crevices to allow free drainage. In compound fractures the extremity is immobilized in a carefully applied plaster cast which is usually not changed and the wound not disturbed for several weeks. In soft tissue injuries without fracture or in compound fractures of the hand or fingers plaster may be omitted and the parts otherwise immobilized after a dry gauze pressure dressing has been snugly applied to the ointment-filled wound. Plaster applied to soft tissue wounds without fracture is changed after about 14 days. When casts are omitted, such wounds are dressed every 3 to 14 days. In any case local sulfanilamide therapy may be employed along with the cod liver oil ointment when indicated.

My conception of the cod liver oil treatment of wounds thus closely resembles Orr's[64, 65] closed petrolatum treatment of osteomyelitis and compound fractures, and the modern closed plaster treatment of war wounds described by Trueta[66, 67] and so successfully employed in the present European war. Orr packs the wound with strips of sterile petrolatum gauze. Trueta employs dry gauze packing. In the cod liver oil method the wound is packed with gauze saturated with cod liver oil ointment.

Since cod liver oil possesses the previously mentioned inherent advantages as a wound dressing not found in petrolatum or dry gauze, the cod liver oil method should theoretically be superior to these other closed methods of wound treatment. I believe that the substitution of cod liver oil ointment for the petrolatum and dry gauze packing now used in the methods of Orr and Trueta respectively will result in superior healing. In order to evaluate the Orr and Lohr methods in treating chronic osteomyelitis, Dengler[68], in 1936, treated 23 cases by Orr's method and compared results with 15 cases using Lohr's cod liver oil. While results with both methods were gratifying, cod liver oil gave superior results: "The wounds healed more quickly and left less conspicuous scars." It is also emphasized that the cod liver oil method is especially useful in soft tissue injuries without complicating fractures.

In treating chronic leg ulcers cod liver oil ointment is applied locally followed by a generous covering of dry gauze. An elastic pressure dressing is then fixed in place after the manner of the "venous heart," and the entire limb firmly bound with an Ace bandage. Thus optimum healing is secured by combining mechanical stimulation of the circulation with the cod liver oil effect.

Closed methods of treatment have proved effective in preventing the development of gas gangrene. But cod liver oil therapy should be used with judgment in badly contaminated wounds, and is not immediately applicable to acute inflammatory lesions. Here the usual surgical measures of incision and drainage, sulfonamide therapy, and especially hot moist sterile saline compresses for a few days are indicated to overcome acute infection. After this preliminary treatment cod liver oil therapy is applied as in clean cases and is unusually effective in cleaning up the infected wound or abscess cavity. Sloughs separate quickly; purulent drainage soon disappears; and healthy granulations develop rapidly. So successful indeed is the cod liver oil treatment of infected wounds that during the past five years I have found it unnecessary to apply the Carrel-Dakin treatment to any wound. Cod liver oil ointment combined occasionally with the judicious use of hot saline compresses now supplants Dakin's irrigations.

Cod Liver Oil Treatment of Burns

Before discussing the cod liver oil treatment of burns a brief review of burn pathologic physiology may be given.

Shock and early toxemia account for 80 per cent of burn deaths. Most delayed fatalities result from sepsis. Local treatment should not be given in the presence of shock, since these early deaths are not favorably influenced by any type of dressing applied to the burn. The fundamental lesion in burn shock is increased capillary permeability at the site of the burn resulting in loss of plasma fluids, hemoconcentration, slowed capillary blood flow, and tissue anoxemia. This produces shock, irreversible tissue changes, and death unless vigorously combated. The important factor in early burn therapy is, therefore, not the attempt to seal the burn and prevent external fluid loss by applying tannic acid or some other coagulant to the burned area, but rather the maintenance of adequate blood volume through prompt replacement of lost protein and fluid by early and repeated plasma transfusions combined with warmth, sedation, position, and other accepted shock treatment. Parenteral saline is not indicated, but glucose may be given to protect the liver. Whole blood transfusions should be used at this stage only when plasma is not available. Plasma requirements are best determined by frequent hemoglobin readings. These gage the progress of shock earlier and more accurately than does the subsequent fall of blood pressure.

Since the popularization of tannic acid and its modifications, it is often stated that greases and oils are contraindicated in burns because they fail to "seal" the damaged tissues. But according to

Clayton[69], cod liver oil differs from other fats and oils in that coagulation in the form of an elastic membrane occurs instantly when the oil comes in contact with the body tissues at the burned area. There is thus a physico-chemical parallellism between the tannic acid treatment and the oil treatment. Tannic acid forms a hard adherent eschar by mutual precipitation of colloids from their aqueous environments, while the oil forms a pliable elastic membrane by interfacial precipitation. This probably accounts for the minimal cicatrization produced by cod liver oil.

In comparing local cod liver oil treatment of serious major burns with the use of tannic acid or other coagulant methods it must not be objected, therefore, that the oil is less effective than a coagulum in sealing the burn and preventing vital fluid loss. The relatively slight external fluid loss which may be prevented by a coagulum is unimportant compared to the tremendous diffusion of plasma into the surrounding tissues which is unaffected by any local dressing and for which plasma transfusions offer an ideal remedy. Furthermore, fluid diffusion in extensive burns is minimized by covering the burn with vaseline gauze and applying a large dry gauze pressure dressing similar to that employed in skin grafting, as recently demonstrated by Allen[70], and by Noland and Wilson[71]; or by using Lohr's plaster bandages. Substituting cod liver oil ointment for vaseline, this is essentially the cod liver oil method. The factor of fluid loss may thus be ignored in evaluating the oil for burns.

My experience confirms Lohr's[1, 3] finding that cod liver oil does not influence shock but is unusually effective in controlling infection. The early saving of life is not dependent on the type of local dressing, but on adequate treatment of shock. Delayed deaths from sepsis, however, are definitely reduced by substituting the cod liver oil method for local coagulant therapy.

This is especially evident in extensive third degree burns. These are the cases which so often develop infection beneath the crust, whether coagulated by tannic acid, silver nitrate, gentian violet, aniline dyes, or some combination of these methods. Coagulant treatment satisfactorily heals the more superficial first and second degree areas. But in deep third degree burns, the coagulum fails either to heal or to prevent infection. Whether clean or infected, these deeper burns heal faster with cod liver oil therapy. Should acute infection develop, it is easily controlled by saline baths or compresses for a few days, after which the oil will soon produce clean healthy granulations. Under cod liver oil, deep burns are recognized early and, between two and three weeks after the accident, are either healing well or ready for skin grafting.

Coagulant methods often require weeks longer to secure a similar result. Deep burns may long remain unrecognized until removal of the crust. Stubborn infection under the eschar may be very resistant when discovered. Worse still, the adherent coagulum must often be removed from unhealed third degree areas either by soaking, which may increase toxemia, or by surgical excision, sometimes under general anesthesia. Excision of the crust, no matter how carefully performed, injures surviving deep epithelial elements, frequently annihilates them, thus prevents healing except from the periphery and increases the necessity for skin grafting.

Cod liver oil reduces infection, forms no adherent coagulum, destroys no epithelial elements, minimizes skin grafting. In 122 cases of severe second and third degree burns thus treated by Lohr[3] no skin grafting was required; and Lohr[3] did not once resort to skin grafting in the cod liver oil treatment of burns over a three and one-half year period. Though I can not confirm such amazing results and feel strongly that skin grafting should be employed early whenever indicated, my experience strengthens the belief that cod liver oil minimizes skin grafting in burns.

For chronic unhealing deep burn ulcerations, whether clean or infected, the cod liver oil method offers unsurpassed advantages. Severe infection may require saline baths or compresses for several days, but will often respond readily to cod liver oil ointment. Once acute infection is controlled, it is in these serious cases that the protective and stimulating properties inherent only in cod liver oil become more manifest. I know no other treatment so effective as the cod liver oil method in dealing with these desperate cases of deep widespread burn ulceration.

Because of its constricting effect tannic acid should not be used on the hands or feet. Nor is it satisfactory on the face, perineum, or in the axilla or groin. For all burns in these locations cod liver oil is the treatment of choice.

Technic for Burns

From admission every severe burn should be treated as a large open wound. Infection must be prevented. No effort should be spared to keep bacteria out of the wound. During shock treatment protection should be afforded by sterile sheets. At the earliest moment when shock is controlled light debridement is carried out, under general anesthesia if necessary. Hands should be scrubbed. Sterile gloves and gown should be worn. Caps and masks must be used by all who enter the room during debridement. The burn is thoroughly cleansed with sterile soap and water, flushed with saline,

and dried. All blisters are opened. Dead skin is excised. A thick layer of cod liver oil ointment is applied to the burned area on fine meshed gauze followed by a dry gauze dressing. Either a cast is employed or the part is encased in a heavy pressure gauze dressing, and immobilized. The cast may be left undisturbed for 14 days or longer. When plaster is not used the burn is dressed every 3 to 14 days. The ointment melts and the oil thoroughly permeates all necrotic tissues. The toxicity of the organisms is reduced if not actually destroyed by the oil. At first there is tremendous activity with

TABLE 2

Analysis of Results in 22 Major Burns Treated with Cod Liver Oil

Name	Age	Per cent of body burned	Degree of burns	Other prev. treatm't.	Infec.	Skin graft	Result.	Scarring.
L. R.	83	17	2 & 3	No	No	No	Well.	Minimal.
G. N.	35	16	2 & 3	No	Yes	No	Well.	Keloid (Tbc).
E. Y.	20	12	1, 2, 3	No	Yes	No	Well.	Minimal.
B. R.	2	26	2 & 3	No	No	No	Well.	Moderate.
E. Y.	18	29	2 & 3	Yes	Yes	No	Well.	Moderate.
S. R.	22	13	2	No	No	No	Well.	Minimal.
M. G.	4	21	3	Yes	Yes	Yes	Well.	Minimal.
L. K.	47	14	3	Yes	No	Yes	Well.	Moderate.
M. M.	23	13	1, 2, 3	No	No	No	Well.	Minimal.
J. D.	44	12	2 & 3	No	No	?	Recovering (3 weeks).	
H. C.	23	27	3	Yes	Yes	Yes	Recovering (7 weeks).	
M. W.	8	18	1, 2, 3	No	Yes	Yes	Recovering (11 weeks).	
W. M.	13	62	2 & 3	No	No	?	Recovering (3 months).	
		—						
		21.5% equals average per cent of body burned in 13 worst major cases.						
E. R.	18	7	3	Yes	Yes	Yes	Well.	Minimal.
J. B.	14	6	2 & 3	No	No	No	Well.	Minimal.
K. H.	41	5	2 & 3	Yes	No	No	Well.	Minimal.
J. M.	16	3	3	No	No	Yes	Well.	Moderate.
S. T.	23	5	2 & 3	No	No	No	Well.	Minimal.
J. C.	31	5	3	No	No	No	Well.	Minimal.
J. D.	47	6	2 & 3	No	No	No	Well.	Minimal.
J. G.	26	3	3	Yes	Yes	Yes	Well.	Minimal.
L. L.	13	5	2 & 3	No	No	No	Well.	Minimal.
		—						
		14.8% equals average per cent of body burned in total 22 major cases.						

Total major cases given other local therapy previous to cod liver oil..... 7
Total such cases which later developed infection..... 5
Total major cases originally treated with cod liver oil.....15
Total such cases which later developed infection..... 3

massive secretion of pus which soon leads to separation of all necrotic material. Early demarcation occurs between the dead tissue and the healthy fresh granulations which develop underneath with surprising rapidity. After all sloughs have separated, secretion is much reduced, and dressings may be changed less frequently. Whenever indicated, skin grafting should be done without delay.

Tables 2 and 3 summarize my experience in the cod liver oil treatment of 62 cases of burns. On the basis of results secured in

22 cases of serious major burns averaging 14.8 per cent of body surface involved and 39 minor burns plus one deep electrical burn I believe that cod liver oil offers an effective therapy applicable to the most severe burns of all types and superior to other methods of treatment.

TABLE 3

Ellen Fitzgerald Hospital Burn Mortality

Jan. 1, 1937 to March 1, 1941.

Total major burns treated with cod liver oil	22 Cases.
Total minor burns treated with cod liver oil	39 Cases.
Total deep electrical burns treated with cod liver oil	1 Case.
Total number of burn cases in cod liver oil series	62 Cases.

Mortality—0%

During the four year period in which these 62 burn cases were treated with cod liver oil, 5 other patients were admitted who promptly died of shock. One of these was treated locally with tannic acid; one with tannic acid-silver nitrate; three received no local treatment. Note: All five fatalities occurred before the establishment of our hospital blood and plasma bank.

Analysis of 5 Fatal Burn Cases.

Name	Age	Per cent of body surface burned	Time between burn and admission	Shock on admission.	Local therapy used on burned area.	Hours patient lived after admission.
W. B.	35	82	1 hour	Severe	Tannic acid	35 hours
E. O.	58	43	1 hour	Severe	None	14 hours
W. S.	41	52	½ hour	Severe	None	10 hours
E. T.	51	80	3 hours	Severe	None	2 hours
F. R.	3	40	7 hours	Severe	Tannic-AgNo3	9 hours

59% equals average body surface burned in 5 fatal cases.

Note: This table suggests that local therapy does not influence fatal shock; 5 deaths in total of 67 burns treated in past 4 years equals mortality of 7.4%.

COD LIVER OIL PREPARATIONS

Rarely is pure liquid cod liver oil applied alone. It is usually more conveniently combined with petrolatum or some other base to form an ointment which has more body. Lohr used an ointment of crude cod liver oil and petrolatum. In this country pure commercial rather than crude cod liver oil has been used. This is produced by chilling out the stearin and certain other fats from the crude oil, and filtering. The many available grades of commercial oil vary greatly in vitamin content. U.S.P. cod liver oil has a minimum requirement of 24,200 units of vitamin A and 2,420 units of vitamin D per ounce. Only oils of at least this potency should be used.

TABLE 4

"Home Made" Cod Liver Oil Ointments.

Preparation	Vitamin Units Per Ounce	Per Cent U.S.P. Cod Liver Oil Content	Ointment Base	Approx. Cost per lb. (Retail).
U.S.P. Cod Liver Oil	24,200 A. 2,420 D.	100%	None	$0.90
50% U.S.P. Cod Liver Oil— Petrolatum Ointment	12,100 A. 1,210 D.	50%	Petrolatum	$0.60
McKesson Cod Liver Oil (High Potency)	70,875 A. 7,087 D.	290%	None	$1.50
50% McKesson Cod Liver Oil —Petrolatum Ointment	35,437 A. 3,543 D.	145%	Petrolatum	$0.90
Meads Cod Liver Oil (High Potency)	51,130 A. 4,960 D.	210%	None	$1.50
50% Meads Cod Liver Oil— Petrolatum Ointment	25,515 A. 2,480 D.	105%	Petrolatum	$0.90
Squibb Cod Liver Oil (High Potency)	51,130 A. 7,371 D.	210%	None	$1.50
50% Squibb Cod Liver Oil— Petrolatum Ointment	25,515 A. 3,685 D.	105%	Petrolatum	$0.90

Table 4 lists the vitamin potencies of a few commercial oils in percentages as compared with that of U.S.P. oil. Also shown are the vitamin percentages of "home made" 50 per cent cod liver oil-vaseline ointments prepared from these various oils, and their approximate costs. The oil itself should not be sterilized since heat destroys the vitamins. It is thoroughly mixed with autoclaved petrolatum in the proportion desired. The resultant ointment is ready for use and should be kept in dark containers.

This home-made ointment composed either of 50 to 80 per cent U.S.P. or high potency cod liver oil and petrolatum was used exclusively during the first four years of my studies with almost universally satisfactory results. During the past year, however, six different leading commercially manufactured cod liver oil ointments have been studied in an attempt to evaluate them clinically in comparison with each other and with home-made cod liver oil-vaseline ointments. These are listed in Table 5 for comparison with the various home-made ointments.

It has not been possible to distinguish clinically between the therapeutic activity of these various commercial ointments. All are effective. But commercial preparations appear definitely superior to home-made ointments. All are elegant preparations. Each has a

TABLE 5

Commercial Cod Liver Oil Ointments.

Preparation	Vitamin Units Per Ounce	Per Cent U.S.P. Cod Liver Oil Content	Ointment Base	Approx. Cost per lb. (Retail).
Patch's Gadoment. The E. L. Patch Co. Boston, Mass.	59,550 A. 5,955 D.	245%	Wax, benzoin, zinc oxide	$2.00
White's Vitamin A and D Ointment. White Laboratories, Inc. Newark, N. J.	54,148 A. 5,414 D.	225%	Petrolatum, etc.	$2.67
Morruguent Ointment. The S. E. Massengill Co. Bristol, Tenn.-Va.	31,650 A. 3,165 D.	125%	Petrolatum, etc.	$2.40
Adestrin Ointment. George A. Breon & Co. Kansas City, Mo.	22,000 A. 3,140 D.	90%	Oxycholesterinated base	$3.00
Nason's Vitaguent. Tailby-Nason Co. Boston, Mass.	15,876 A. 1,700 D.	65%	Zinc borosalicylate, etc.	$2.00
Unguentum Morrhu-Comp. Hart Drug Corp. Miami, Fla.	14,500 A. 1,450 D.	60%	Emulsion	$2.00

pleasing odor, a genuine advantage over the fish odor of home-made ointments. All the commercial ointments keep indefinitely at room temperature. None becomes rancid as does the home-made ointment. They cost a little more, but are worth it.

Each of these commercial ointments has its own special ointment base; and each has certain advantages. It appears probable that those ointments reputedly possessing the higher vitamin potencies as listed are somewhat more effective than those whose vitamin potency is less than that of U.S.P. oil. Excessively high vitamin potency is contraindicated, however, for Lohr and Unger found that a concentration of vitamins much higher than that found in the natural state of cod liver oil retards rather than accelerates wound healing. Certainly it is unwise to evaluate the therapeutic activity of cod liver oil ointments solely on their vitamin contents.

ILLUSTRATIVE CASE REPORTS

CASE 1. A married woman of 22 was seen in consultation with Dr. Oren Moore to whom she had been referred nine months before because of severe chronic progressive undermining burrowing ulceration of the abdomen. This

had followed a simple appendectomy performed elsewhere four months previously. Great improvement followed three weeks' hospital treatment under Dr. Moore's care. But after two months of home treatment with Dakin's solution under two special nurses she returned in worse condition. She then showed an ulcer larger than a square foot in area involving the ventral wall of most of the lower abdomen with deeply undermined suppurating edges and sinuses extending far to the right flank and under the pubic bone. All tissues including fascia had been destroyed down to the muscle exposing most of the iliac crest, and the ulcer was bathed in pus. Suffering agony, again a morphine addict, and toxic from high fever, the patient's condition was desperate.

Repeated blood cultures were negative. Wound cultures always showed Staphylococcus aureus. It is unfortunate that anaerobic cultures were not made. Undoubtedly they would have demonstrated the micro-aerophilic hemolytic streptococcus reported by Meleney[72, 73] in 1935 to be the causative agent in chronic undermining burrowing ulcer of which this was clinically a typical example. The finding of this organism might have prompted the use of zinc peroxide which Meleney has proven such an effective cure in these cases.

Systemic disease was ruled out. For two weeks the wound was dressed with bismuth violet, but the ulceration progressed until Dr. Moore performed wide cautery excision of the entire diseased tissue. This temporarily stopped the ulcer's progress. But bismuth violet, Dakin's solution, saline and peroxide irrigations, staphylococcus vaccine, Thiersch grafting, and other treatments suggested by many consultants accomplished practically no healing during the next five and one-half months, and the wound edges again became deeply undermined. Anorexia resulted and severe anemia developed despite repeated blood transfusions; wound dressings caused frightful pain; and her condition steadily deteriorated. Figure 1 shows the ulceration soon after cautery excision by Dr. Moore and before emaciation became marked.

When first seen with Dr. Moore at the Presbyterian Hospital on Feb. 25, 1938, thirteen months after the ulceration began, the patient's weight had fallen from 135 to approximately 70 pounds, severe flexion contractures of knees and thighs were present, and her morale was utterly shattered. The ulcer appeared only a little smaller than in fig. 1, but was more deeply undermined. Although the outlook appeared hopeless, cod liver oil therapy was advised. Fifty per cent cod liver oil-vaseline ointment on gauze was applied locally. Every twelve hours cod liver oil was poured on, and dressings were changed every two days. The result was miraculous. Within thirty-six hours she became comfortable and slept without pain for the first time in months. On the eleventh day she was up in a chair after three months in bed. Almost overnight the wound took on new activity and soon was covered with fresh, clean, healthy, red granulations. Large areas filled in. Within a month the size of the ulcer was reduced more than 40 per cent, its area being now about 70 square inches (fig. 2).

Five weeks after starting cod liver oil treatment the entire area was grafted under cyclopropane with thick split skin grafts after excising the granulations and cutting away overhanging edges above the pubis. The graft covered about 72 square inches. The wound had been further prepared by continuous sterile saline compresses for 48 hours previously, and appeared clean. But probably because of infection persisting under the pubis or because of movement of the abdomen the grafts became infected, and only a 15 per cent "take" resulted. However, from scattered areas of viable graft epithelization proceeded under

cod liver oil therapy so that soon a third of the wound was healed. Subsequent grafting by Drs. Moore and J. Stuart Gaul and the constant use of cod liver oil completed the epithelization; and seven and one-half months after cod liver oil therapy was instituted the twenty-months-old ulcer was completely healed. No photographs were obtained.

Fig. 1. Appearance of abdomen 10 months after ulceration began and 1 month after wide cautery excision of necrotic suppurating undermining wound edges (case 1).

Fig. 2. Result of 1 month's treatment with cod liver oil ointment. Compare with Fig. 1 (case 1).

Unfortunately, some of the donor sites on the thighs were cut too deeply at the skin-grafting operation, and subsequently became infected with the original ulcerative organism. In spite of all treatment these progressively ulcerated until one thigh was honeycombed with deep necrosing ulcers which in places burrowed to the femur. Because of flexion contractures they could not be kept free of discharge, and continued to burrow hopelessly. In these pus-filled sinuses cod liver oil was without effect.

While the abdominal ulcer was healing under cod liver oil the patient showed general progressive improvement. But six weeks after the abdomen had healed she developed lobar pneumonia and died.

This is a typical case of chronic undermining burrowing ulcer caused by a microaerophilic hemolytic streptococcus demonstrable only on anaerobic culture as described by Meleney[72, 73]. Heretofore the only effective treatment reported has been the use of zinc peroxide. This is the first reported cure of this rare type of ulceration by means of cod liver oil therapy. Complete healing occurred in seven and one-half months after treatment with a variety of antiseptic agents had previously proved ineffective for thirteen months.

Fig. 3. Showing excellent healing 6½ weeks after beginning treatment with cod liver oil ointment. Note large ventral herniation and healed ulceration of flank. See also counter incision deep in right flank indicating extent of undermining ulceration (case 2).

Fig. 4. Final appearance 20 days after successful repair of large ventral hernia (case 2).

CASE 2.—P. A., a 34-year-old laborer, underwent appendectomy Feb. 16, 1938, through a McBurney incision which required upward enlargement for removal of an immovable deeply placed retrocecal subacute appendix reaching to the liver. Operation was difficult and heavy traction necessary. Postoperative ileus with serious vomiting almost proved fatal, and together with severe distention, caused wound disruption. By the twelfth day grave infection had completely ruptured the wound and destroyed the entire belly wall over an area measuring 4½ by 2½ inches within which the intestines, covered with exudate, lay free. Simultaneously, a larger necrosing area of cellulitis developed posterolaterally in the right flank. With alarming rapidity all soft tissues between the two wounds were destroyed down to the fascia by a progressive undermining ulceration which spread 4 inches under the skin deep into the right flank. Here a counter incision was made for drainage, and on the sixteenth day all wounds, including the naked intestines, were dressed with 50 per cent cod liver oil ointment on gauze.

Progressive ulceration stopped immediately, infection rapidly subsided, and excellent healing began. The patient was discharged on the fortieth day, and healing was completed under cod liver oil therapy at home within three weeks

(fig. 3). Some months later the extensive ventral hernia was successfully repaired, using Babcock's rustless steel wire throughout. The skin scar was found widely adherent to the underlying intestines. Figure 4 illustrates the final appearance of the wound twenty days after herniorrhaphy. The patient remains in good health doing hard manual labor.

This is the first reported case describing the successful application of cod liver oil to the naked intestines. It demonstrates the effectiveness of the oil in stopping a serious rapidly progressive burrowing ulceration following grave infection and rupture of an abdominal wound. Cod liver oil prevented the development in this case of an uncontrollable ulceration similar to that which occurred in Case 1, and proved life-saving.

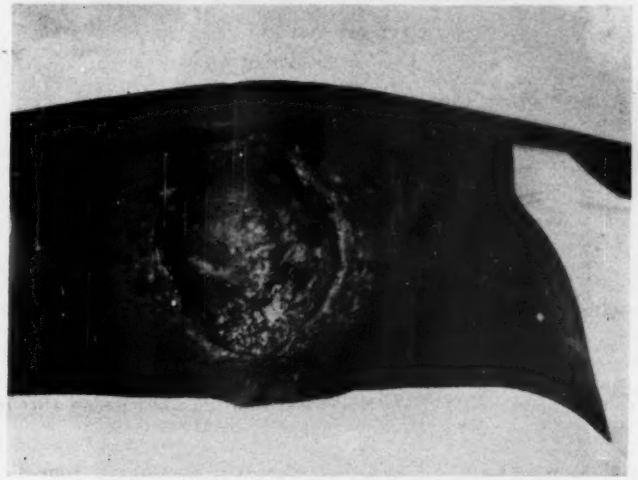

Fig. 5. Showing intestines covered with granulations 10 days after starting cod liver oil therapy in complete abdominal wound rupture (case 3).

CASE 3.—L. H., a 25-year-old negro woman, developed a fulminating wound infection following a difficult prolonged hysterosalpingectomy without drainage for severe chronic pelvic inflammatory disease. Complete dehiscence occurred on Sept. 7, 1940, the ninth postoperative day, with wide separation of the undermined wound edges, extensive rupture of the peritoneum, and considerable eventration of the intestines which bulged into the necrotic depths of the wound covered with pus. The wound was immediately packed with adestrin cod liver oil ointment on gauze applied directly to the eviscerating intestines followed by dry gauze and adhesive strapping. There was no further evisceration. General peritonitis did not occur. Cod liver oil dressings were replaced every 3 or 4 days. The wound soon cleaned up nicely with reduction of the profuse purulent discharge and rapid formation of healthy granulations. Figure 5 taken September 17, ten days after starting cod liver oil therapy, shows intestines covered with granulation tissue. On October 10, after a month of adestrin ointment treatment, the widely gaping edges of the wound were easily approximated with multiple interrupted rustless steel wire sutures placed down to the healthy granulations, with a central drain. Healing was

complete by December 1, twelve weeks after dehiscence. Figure 6 taken Jan. 9, 1941, four months after wound rupture, shows final strong healing. There is no hernia; the patient remains well.

This is the second reported case of the successful direct application of cod liver oil ointment to the intestines in complete rupture of an abdominal wound with serious infection. It illustrates the satisfactory cleaning up of a grave infection by cod liver oil therapy.

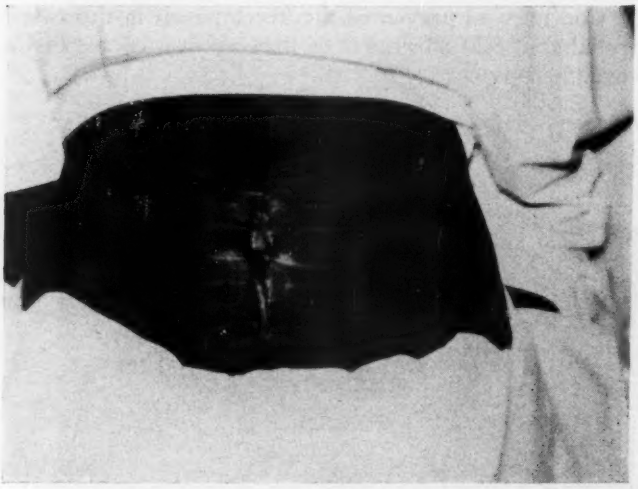

Fig. 6. Final appearance 4 months after wound rupture and 3 months after secondary closure with rustless steel wire. No hernia (case 3).

CASE 4.—J. S., a farmer, aged 62, was rushed to the hospital June 8, 1938, immediately after his gloved right hand had been mangled in a threshing machine. There were multiple compound comminuted fractures of thumb, all fingers, and three metacarpals. The thumb was nearly severed by multiple lacerations. There was complete avulsion of the index and middle fingers, which hung only by shreds and were not viable. The fourth and fifth fingers were very gravely lacerated, while all soft tissues of the dorsum had been torn from the hand with extensive tissue loss, division of all extensor tendons, and practically complete disintegration of the entire hand (figs. 7 and 8).

At operation, under ether, the extremity was thoroughly washed with soap and sterile water, and extensive plastic repair accomplished, especial attention being devoted to minimal debridement and careful preservation of all viable tissue. After completing the amputation of the index and middle fingers, all comminuted compound fractures of thumb and fingers were reduced, surviving tendons sutured with silk, dorsal soft tissues re-established, index and middle metacarpal exposed ends covered with tissue, and appropriate drainage placed under the dorsal flap. No skin sutures were used. The injury was dressed with continuous warm saline gauze compresses, with digits splinted in semi-flexion. Fever of 102 degrees on the second day fell to normal on the fifth day; no infection occurred.

Fig. 7. Extensive soft tissue destruction and multiple comminuted compound fractures with practically complete disintegration of hand (case 4).

Fig. 8. Roentgenogram of hand (case 4).

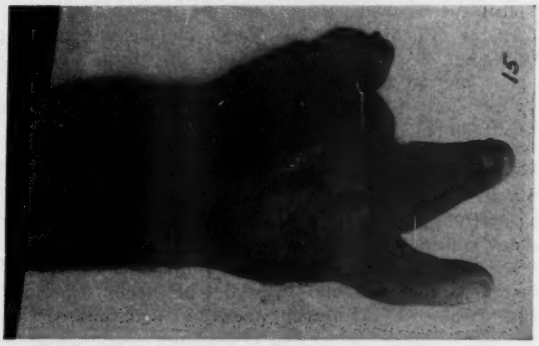

Fig. 9. Final result 6 months after repair and treatment with cod liver oil ointment. Note minimal scarring and excellent covering of dorsum of hand and of metacarpal ends. Compare with Figs. 7 and 8 (case 4).

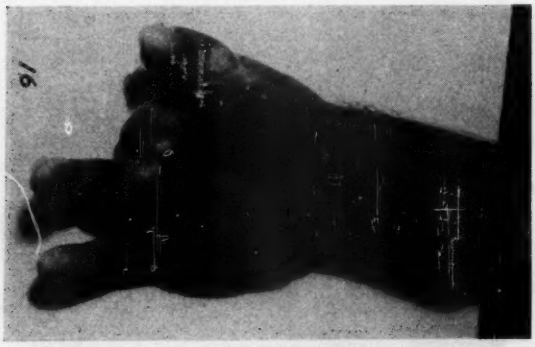

Fig. 10. Final appearance of palmar surface of hand (case 4).

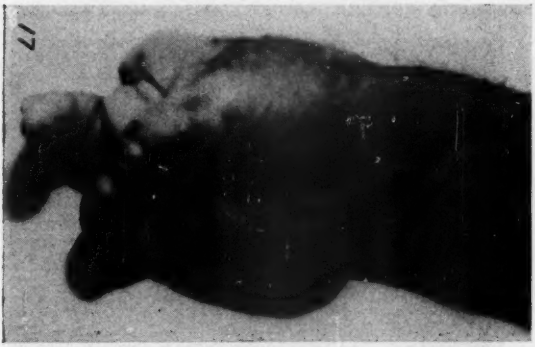

Fig. 11. Showing good functional result with satisfactory motion of thumb and fifth finger. Note ankylosis of fourth finger. Compare with Figs. 7 and 8 (case 4).

On the fifth day the wound was liberally dressed with 50 per cent cod liver oil-vaseline ointment saturated gauze, and the patient discharged. The hand was dressed in the dispensary for ten weeks, and healing was complete after several months (figs. 9, 10 and 11). There is surprisingly little scarring. The thumb has good motion and can be approximated to the normal fifth finger and the ankylosed fourth finger, giving a very useful hand. This excellent result must be attributed largely to cod liver oil.

CASE 5.—N. R., aged 37, had his right thumb amputated by a buzz-saw on Sept. 6, 1940, dividing the metacarpal at its distal two-thirds and leaving a wide open wound extending to the base of the thenar eminence with comminution of the bone and considerable muscle destruction. Figure 12 shows the wound when first seen two and one-half hours after the accident. The surrounding skin and wound were thoroughly scrubbed with sterile soap and water under local procaine anesthesia. Minimal removal of comminuted bone fragments was done, leaving as much metacarpal as possible. Deep tissues were partially sutured without tension with plain 1 catgut; and the skin over the base of the thenar eminence was closed with interrupted silk over the proximal half of the wound. The remainder of the wound for about 4 cm. gaped open 2 or 3

Fig. 12. Traumatic amputation of thumb with wide soft tissue loss. Primary closure of proximal half of wound. Distal wound left open and treated with cod liver oil ointment (case 5).

Fig. 13. Complete healing on 24th day. Photograph showing final result on 27th day (case 5).

cm., and was dressed with Nason's vitaguent cod liver oil ointment. The hand was immobilized, and dressings changed every three days. No infection occurred and the sutured wound healed per primam. The remaining open wound granulated in very rapidly, and was completely healed 24 days after the amputation. Figure 13 taken the twenty-seventh day shows perfect healing, good motion, and excellent function.

CASE 6.—Y. R., a white ginner, aged 28, had his right arm literally torn to shreds when caught in the gin machinery on Oct. 31, 1940. Examination soon after the accident showed traumatic amputation of the hand with disintegration of carpal bones, compound fracture of lower radius, and an indescribable injury involving all soft tissues of the forearm proximally to within 6 cm. of the antecubital space. Six deep oblique lacerations across the dorsal forearm merged distally into multiple linear lacerations. All soft tissues including skin, fascia, muscles, and interosseous membrane were torn into shreds. Many long flaps of skin and fascia, and all muscles of the lower forearm torn loose from the bones were hanging free (fig. 14). Under ether anesthesia, surrounding areas and all parts of the injury were thoroughly scrubbed for ten minutes with sterile soap and water. Uninjured skin was swabbed with tincture of merthiolate, but no antiseptic was used in the wound. Conservative amputation was performed 3½ inches above the wrist at the lowest possible point where tissues appeared viable. Debridement was very carefully performed, removing only a few shreds of hopelessly injured muscles, fascia, subcutaneous tissue and skin tags, and leaving all potentially viable tissues including many long narrow skin flaps. The entire mass of shredded, loosely attached soft tissues was pulled distally and molded around the bones forming a generous covering of the bone ends. Half a dozen zero chromic stitches

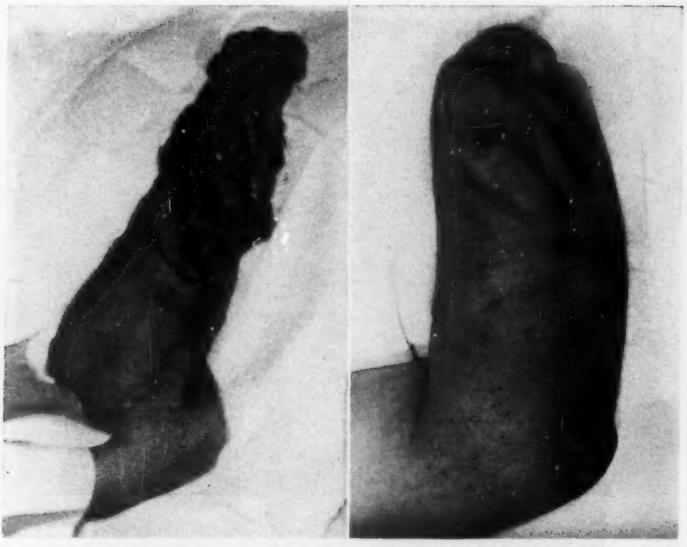

Fig. 14. Traumatic amputation of right arm by machinery with shredding and severe soft tissue damage and loss (case 6).

Fig. 15. Final result showing complete healing under cod liver oil ointment 11 weeks after injury. Photograph taken at 12 weeks. Note maximum preservation of all tissues, and bone ends well covered with soft tissue. Scarring is minimal (case 6).

loosely closed the deep muscles. No other sutures were used. All portions and recesses of the wound were thickly covered with morruguent ointment, a snug dry gauze dressing was applied, and the arm elevated. Combined gas and tetanus antitoxin was given, and large doses of sulfanilamide administered orally for four days. The highest temperature was 100.8 degrees on the second day, falling to 99.6 on the fourth day, and soon reaching normal. Because the patient was to be transferred to a hospital in another city, the wound was dressed on the fourth day. There was no infection, very little sloughing, and the tissues appeared healthy. Morruguent ointment was again used locally and dry gauze applied. After transfer, the temperature remained normal, but the attending physician preferred to use a daily saline dressing, though no infection developed. After three weeks the patient was returned home where 50 per cent cod liver oil ointment dressings were applied every 4 or 5 days. He returned to work five weeks after the injury and was completely healed eleven weeks after the accident. Figure 15 shows the excellent final result at twelve weeks.

This patient presented a compound injury to the arm of maximum severity. By the use of the cod liver oil method infection, gas gangrene, and osteomyelitis were avoided; maximum bone and soft tissue were preserved; and rapid healing produced a long useful forearm stump with the bone ends well covered with thick, freely movable soft tissue. The final result is superior to all expectations.

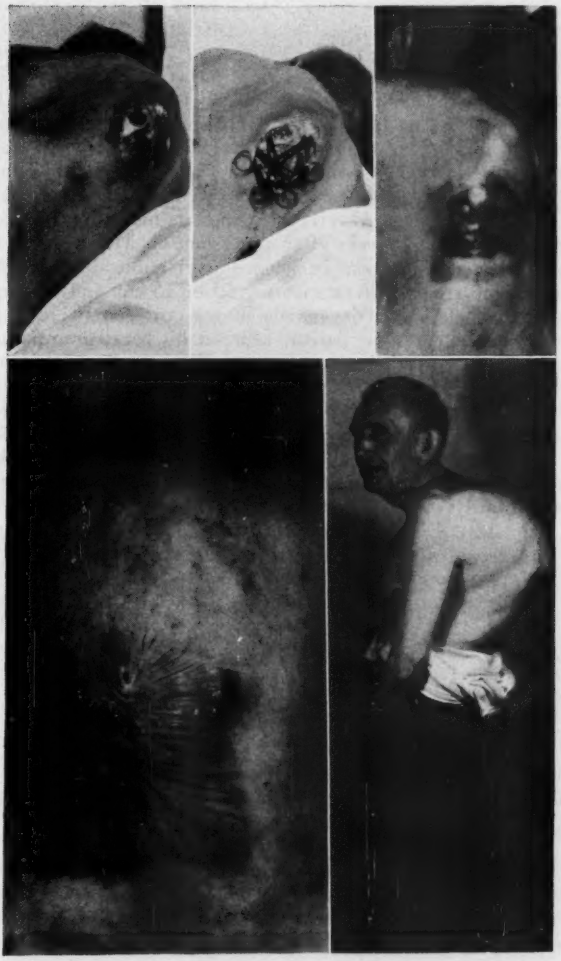

Fig. 16. Large decubitus ulcer over prominence of congenital kyphos. Note sloughing fascia (case 7).

Fig. 17. Same ulcer with hemostats demonstrating deeply undermined edges (case 7).

Fig. 18. Appearance of ulcer after 10 weeks of cod liver oil ointment therapy following wide excision of undermined edges. Size of ulcer now measures only 40 per cent of that illustrated in Figs. 16 and 17 (case 7).

Fig. 19. Final result. Completely healed after 6½ months of cod liver oil therapy. Scar is small, soft, non-adherent except in center, and has no tendency to break down (case 7).

Fig. 20. Final result. Patient well. Note marked right angled congenital kyphos deformity and position of healed decubitus ulceration (case 7).

CASE 7.—N. L., aged 57, entered March 25, 1940, with multiple fractures of the right leg and an intertrochanteric fracture of the left hip. The fractured leg was reduced and a cast applied. A marked congenital kyphos producing a right angle deformity of the thoracic spine prevented application of a spica and necessitated treatment of the fractured hip in extension. With the patient necessarily immobilized on his back a serious decubitus ulcer inevitably developed over the kyphos. Five weeks after admission, when the patient could be turned on his sides for the first time, the ulcer measured 10 by 13 cm. with a depth of 1.2 cm. Infection was present with much sloughing of fascia. Figures 16 and 17 show the ulcer on May 1, the hemostats indicating the edges undermined for 2 or 3 cm. Six weeks after admission, on May 4, wide excision of the undermined ulcer edges was performed with removal of sloughing fascia and infected granulations. Now measuring 13 by 15 cm. and 1.5 cm. deep, the ulcer was dressed every few days with 50 per cent cod liver oil petrolatum ointment on gauze. With the patient kept off his back, granulations quickly filled in, and by August 10, ten weeks after the operation, rapid healing had reduced the ulcerated area to 7.5 by 10 cm. (fig. 18). On that date a thick split skin graft was carefully sutured to cover the entire ulcer from which the granulations had been excised, but failed completely to "take" because it slipped from the kyphos. This delayed healing. Thereafter, the ulcer was dressed every few days with unguentum morru-comp on gauze, and it continued to heal satisfactorily. Thirteen weeks after operation, on August 5, the ulcer measured only about 4 by 5 cm., and the patient was discharged to the County Home where attendants dressed it with unguentum morru-comp every few days. Healing was complete by November 15, approximately six and a half months after operation, the patient making an excellent recovery from his fractures. Figures 19 and 20 taken Jan. 3, 1941 (eight months after operation) show only a small soft scar which is freely movable except at its center where it is deeply attached.

Cod liver oil treatment of this terrible ulcer was very effective, painless healing resulting with minimal scarring. The healing time might have been considerably shortened had the patient remained under direct surgical supervision instead of being transferred from the hospital to the County Home.

CASE 8.—W. L., a 20-year-old negro, was shot in the left side June 15, 1939. From a distance of 10 feet the entire shotgun load penetrated the ala of the ileum and passed to the midline of the pelvis. Figure 21, the admission roentgenogram, shows the compound comminuted fracture of the ilium with multiple shot and bone fragments carried to the midline of the pelvis. Laparotomy revealed that the entire charge had passed retroperitoneally causing an extensive hemorrhage which stripped up the posterior peritoneum and bulged into the lower abdomen and pelvis. Miraculously, there was no intra-abdominal or pelvic perforation and no aortic or bladder injury. The abdomen was closed without opening into the retroperitoneal space. After thorough soap and water scrubbing the gunshot wound through the shattered ilium was explored. Multiple shot and bone fragments were removed. The external wound was thoroughly debrided. The deep retroperitoneal wound was then packed with a dry gauze uterine pack to control bleeding, and a pressure dressing applied. The patient reacted well after a transfusion.

Postoperative Course: Sulfanilamide and tetanus antitoxin were administered. On the fifth day the packing was removed under gas. The wound was foul with pus; and much debris, many shot, and some additional bone frag-

R L R L

Fig. 21. Admission roentgenogram of compound shot gun wound through left ilium. Note hole through ilium and multiple shot carried retroperitoneally to midline of pelvis (case 8).

Fig. 22. Roentgenogram 4½ months after injury. Only a few shot remain inside compound fracture wound of ilium. No osteomyelitis (case 8).

ments were removed from the depths. Bleeding having ceased, the entire wound which was over 7 inches deep was packed with 50 per cent cod liver oil-vaseline ointment on gauze. The patient did well. Six days after first dressing, the packing was again changed under gas. The wound was found cleaning up nicely under cod liver oil ointment. Drainage was moderate, more shot and debris were removed, and cod liver oil ointment gauze packing re-

Fig. 23. Appearance of wound at 4½ months. A small sinus still leads to the hole in the ilium (case 8).

Fig. 24. Showing final result of compound shot gun wound through left ilium treated with cod liver oil ointment. Complete healing 7½ months after injury Close up photograph at 21 months (case 8).

placed. Abdominal wound healed per primam. On the thirteenth day the patient was up in a chair, and soon walked. Three and one-half weeks after the injury he was discharged still running one-half degree of fever. The wound still discharged considerable pus, shot, and an occasional bone fragment. Originally 7 inches deep, the wound was now only 3½ inches deep, showed good granulations, and was healing rapidly under cod liver oil dressings changed every 3

or 4 days, and continued in the dispensary. Figure 22 shows the roentgenogram taken Nov. 2, 1939, four and a half months after the injury. Only a few shot remained inside the ilium with no evidence of osteomyelitis in the fractured bone. Figure 23 shows the appearance of the wound on the same date. Only a small sinus remained down to the perforated ilium. The patient felt fine at this time and was working. Under ether the entire scar tissue about the sinus tract was widely excised, leaving a cone-shaped opening down to the fracture in the ilium. The wound was found clean, without osteomyelitis. One old bone fragment and additional shot were removed. There was excellent healing by clean granulations from just inside the compound fracture hole in the ilium. The wound was packed with 50 per cent cod liver oil ointment, and the patient discharged after a week. Dressings were changed infrequently in the dispensary. Healing was rapid and, by Feb. 1, 1940, seven and a half months after the injury, complete healing had occurred. Figure 24 is a close-up view of the healed gun shot wound taken 21 months after the boy was shot.

This case illustrates the effect of cod liver oil in cleaning up a serious deep gun shot compound fracture wound which formerly would have been treated by Dakin's irrigations, etc. Excellent rapid healing occurred seven and a half months after the injury without the development of osteomyelitis. The final result was perfect.

Fig. 25. Extensive deep third degree burn of right lower extremity photographed on 21st day, 24 hours after surgical excision of adherent tannic acid crust (case 9).

Fig. 26. Another view showing depth and extent of third degree burn. Note exposed tendon of biceps femoris (case 9).

CASE 9.—L. O. K., aged 49, critically burned over 41 per cent of the body when a blow torch ignited his clothing Sept. 30, 1935, was seen immediately and did well under tannic acid treatment. In less than three weeks the coagulum separated from the second and third degree burns of the entire face and neck, both arms and hands, medial left buttock, thigh and leg, and entire pe-

rineum. These eventually healed with considerable scarring. Because the coagulum remained densely adherent, it was excised surgically from the entire right lower extremity on the twentieth day. Figures 25 and 26 taken the next day show the entire limb except the upper anterior thigh, ankle and foot involved in a destructive third degree burn so deep that the tendon of the biceps femoris is clearly exposed.

Fig. 27. Final result at 9 months after treatment with cod liver oil ointment and two skin grafting operations (case 9).

Fig. 28. Final result at 9 months. Note smooth healing of grafted thigh and upper leg contrasted with increased scarring of ungrafted portion of lower leg. Compare with Fig. 25 (case 9).

Treatment of this extensive deep ulceration measuring approximately 3¾ square feet in area presented a most serious problem. Lack of facilities precluded the use of a saline bath. Open air treatment under a lighted burn tent caused unbearable pain, and the agony accompanying boric ointment dressings for two days indicated that some other therapy was imperative. I then tried cod liver oil for the first time in my experience. Fifty per cent cod liver oil-vaseline ointment was applied to the limb on gauze, and the entire limb wrapped in sterile towels. Every eight hours cod liver oil was poured on the gauze and the dressings were changed every two days.

Immediate striking relief from pain resulted. The oil saturated dressings never adhered to the wound and were changed without pain; the patient was comfortable and contented. In a remarkably short time all sloughs separated; the wound was converted into a clean ruddy surface covered with healthy granulations, and was deemed ready for skin grafting nine days after cod liver oil therapy was started. The family delayed grafting for five weeks; but on the sixty-sixth day, 90 square inches of thick split skin grafts taken from the patient's left thigh were applied to the medial and lower anterior right thigh, entire knee and popliteal space, and part of the medial and anterior leg by

Blair's[75] technic. A 100 per cent successful "take" resulted. Cod liver oil ointment therapy was continued meantime, and two and one-half months later at a second operation 87 square inches of thick split skin grafts were transferred to the unhealed right buttock, posterior thigh, and parts of the leg with a 95 per cent successful "take". Further surgery being refused, cod liver oil treatment was continued at home.

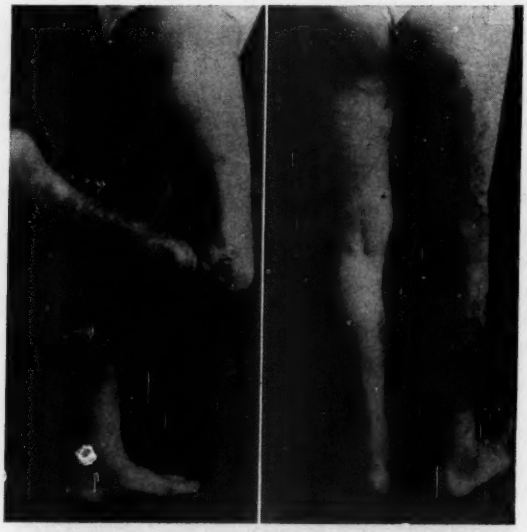

Fig. 29. Showing excellent functional result. Note absence of contractures or deformity about knee joint (case 9).

Fig. 30. Final result at 9 months. Note smooth healing of thick split skin grafts and satisfactory cosmetic appearance (case 9).

The patient walked at eight months. Figures 27, 28, 29 and 30 show him completely healed with excellent function at nine months. He returned to his former occupation ten months after the accident with a 5 per cent disability rating for slight heel cord shortening. This soon disappeared under treatment. The patient remains in perfect health, and working.

Following adequate tannic acid treatment this man presented an unhealed third degree ulceration involving practically an entire lower extremity measuring approximately 530 square inches in area. Tissue destruction was so deep that epithelization could progress only from the periphery, all epithelial elements throughout having been destroyed by the burn and by the excision of the adherent coagulum. One-third of this area, equalling 177 square inches, was successfully restored by skin grafting. The remaining two-thirds measuring 2¼ square feet was healed in nine months by cod liver oil therapy, with a perfect final result. Had cod liver oil instead of tannic acid been employed in the beginning, it appears probable that any epithelial elements still surviving within the burned area

might have been saved. This would have allowed epithelization from scattered islands throughout the ulceration with consequent shortened healing. As it was, the case demonstrates well the failure of tannic acid to deal with the deeper types of burns, and fully illustrates the advantages of cod liver oil therapy.

CASE 10.—M. G., a child of 4, sustained severe third degree flame burns of the entire back, left side, and part of left arm on Nov. 25, 1939, equalling 21 per cent of the body surface. At home her doctor merely anointed the burns with some sort of ointment, but after 36 hours she was hospitalized. On admission her temperature was 103 degrees, pulse rate 136 per minute, hemoglobin 104 per cent, leukocytes 16,000, polymorphonuclears 78 per cent, and urine negative. With no particular debridement, her physician dressed the burns with Patch's gadoment cod liver oil ointment applied on gauze every few days. The patient required no parenteral fluids and was not transfused until after the extensive skin grafting operation performed later by me. Figure 31 shows the appearance of the burn eight days after admission. In spite of an irregular fever of 101-104 for several weeks, she showed no gross infection; and general condition was reasonably good. Eighteen days after admission she showed a third degree ulceration of the back, side, and arm measuring about 120 square inches and requiring skin grafting. Under gadoment ointment the granulations were clean and ready for grafting. Following continuous sterile saline compresses to the granulations for 48 hours, operation was performed on the twenty-third day after the burn. A number of thick split skin grafts with total area of about 50 square inches were removed from the thighs and grafted directly to the patient's back, side, and arm without excising the granulations. Since it was impossible to cover the entire denuded surface at one operation, the grafts were arranged with areas of granulation remaining between them. A 90 per cent successful "take" resulted. Figure 32 shows the grafted area three weeks after operation. On February 7, seven weeks after operation, she was discharged with the ungrafted areas healing rapidly under gadoment ointment, and healing was complete three weeks later, approximately three months after being burned.

Figure 33 shows the patient eleven months after recovery. There is minimal scarring with no fixation, and it is impossible to tell which parts were grafted and which healed under cod liver oil. Final result is excellent. Note good cosmetic result with practically invisible donor scars on thighs. Practically all of this severe 21 per cent burn was third degree, yet healing was excellent under cod liver oil therapy.

CASE 11.—W. M., a colored girl of 13, sustained second and third degree kerosene burns of half the face and neck, three-fourths of the upper extremities, the entire chest, abdomen, back, both sides of the trunk, and half the buttocks and thighs totalling 62 per cent of the body surface, Dec. 15, 1940. Dr. H. H. Craft saw her two hours after the accident, and treated her unassisted at home. He washed the burns with soda bicarbonate solution, opened blisters, did not excise burned skin, dressed the burns daily with a mixture of 80 per cent cod liver oil and 20 per cent butesin picrate, applied gauze, and used a burn tent. Fluids were forced orally, but neither parenteral fluid nor transfusion was given. Opiates were never required. No laboratory work was done. The patient was delirious on the fifth day, but thereafter improved progressively.

When first seen in consultation on the twenty-ninth day, the child was bright, cheerful, and comfortable. In spite of temperature of 102.8 and pulse rate of 160 per minute, she did not appear toxic. Much healing had occurred;

Fig. 31. Severe third degree burn of entire back, left side, and part of left arm treated with cod liver oil ointment. Photographed on 8th day (case 10).

Fig. 32. Satisfactory "take" of multiple thick split skin grafts 3 weeks after operation. Note healthy appearance of granulations between grafts under cod liver oil therapy (case 10).

there was considerable scaling and crusting; but the abdomen and chest showed good clean granulations. There was a deep lumbar bedsore. On the thirty-first day figures 34 and 35 were taken; and she was started on dressings of 80 per cent cod liver oil-petrolatum ointment on gauze changed every few days. Five days later she showed hemoglobin 48 per cent, the red count

2,510,000, white count 14,200 with 78 per cent polymorphonuclears; the urine had a specific gravity of 1.026, but was negative for albumin, blood cells, or casts. Temperature was down to 101, and pulse rate 144 per minute. Adequate diet and hematinic medication were instituted.

Fig. 33. Final result photographed at 11 months. Complete healing at 3 months. Note excellent cosmetic result with minimal scarring. Impossible to differentiate between grafted areas and ungrafted areas which healed under cod liver oil (case 10).

By the forty-fifth day considerable edema of face, left arm and feet developed. This cleared up, and the urine remained negative. Eight weeks after being burned the back showed almost complete healing while under cod liver oil dressings epithelium covered more than half of the abdomen. Figures 36 and 37 taken Feb. 27, 1941, show excellent healing of over 80 per cent of the burns ten and one-half weeks after the accident. Remaining granulations are clean, and rapid healing continues. Skin grafting will not be required. Temperature is 100 degrees, and pulse 120-130 per minute. No transfusion has been given, but under proper diet, adequate medication, and oral vitamin B and C administration the severe anemia is improving.

In spite of home treatment under conditions far from ideal, this patient, burned over 62 per cent of the body, has escaped infection and continues to show remarkably rapid healing under cod liver oil therapy. She is not toxic and is daily growing stronger. Except for the increasing severity of the lumbar decubitus ulcer, her chances for

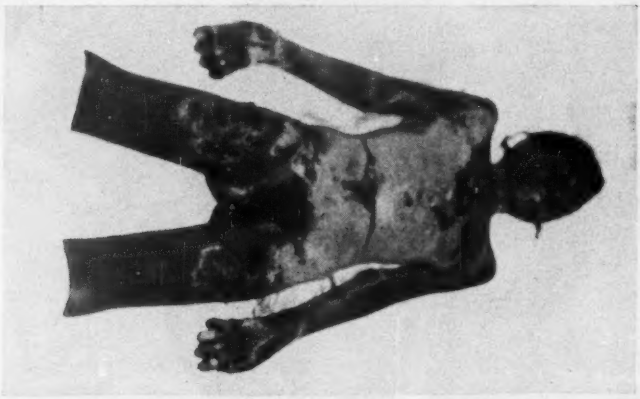

Fig. 34. Thirteen year old colored girl with 2nd and 3rd degree burns of 62 per cent of the body treated with cod liver oil ointment. Photograph taken on 31st day (case 11).

Fig. 35. Showing burns of entire back and left side of body photographed on 31st day. Note deep decubitus ulcer (case 11).

ultimate recovery appear excellent. The circumstances surrounding this unusual case are dramatic proof of the effectiveness of the cod liver oil therapy of burns.

CASE 12.—H. Y., an electric linesman, aged 28, was rendered unconscious by an 11,000 volt shock Dec. 16, 1940. When first seen four days after the accident the right palm showed four deep electric burn blisters, and the left forefinger showed necrotic blisters on the dorsum of the two distal phalanges,

and between two fingers. All blisters were excised and the burns dressed with White's vitamin A and D ointment every 4 or 5 days. The other burns healed rapidly, but three weeks after the accident the left forefinger showed the deep destructive sloughing typical of severe electrical burns illustrated by figs. 38 and 39 taken Jan. 7, 1941. The extensor tendon had sloughed out, and the

Fig. 36. Appearance of burns 10½ weeks after the accident showing satisfactory healing of 80 per cent of burns under cod liver oil ointment. Abdomen almost completely healed. Note good general condition of patient (case 11).

Fig. 37. Another view showing complete healing of back, left side, arm, and thigh after 10½ weeks of cod liver oil treatment. Note increased size and severity of sacral decubitus ulcer (case 11).

distal interphalangeal joint was fully exposed. Amputation appeared possibly necessary. However, under White's vitamin A and D ointment, with infrequent dressings and a finger splint, sloughing rapidly cleaned up, and granulations filled in the extensive defect with unusual celerity. Seven and one-half weeks after the injury healing was complete, as shown by figs. 40 and 41 taken on February 15, five weeks after figs. 38 and 39, and two months after the accident.

This case demonstrates the remarkable healing effect of cod liver oil ointment, with granulations filling in rapidly over exposed bones

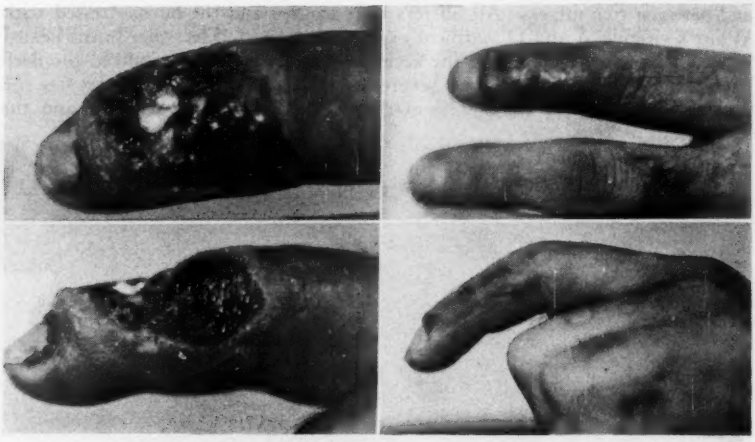

Fig. 38. Deep burn of forefinger caused by 11,000 volt shock with sloughing of extensor tendon and exposure of interphalangeal joint. Appearance at 3 weeks (case 12).

Fig. 39. Lateral view showing depth of sloughing and exposed bones (case 12).

Fig. 40. Final result showing complete healing with no infection as result of cod liver oil ointment treatment in 7½ weeks. This photograph taken at 4½ weeks after Fig. 38 (case 12).

Fig. 41. Final result. Lateral view taken 4½ weeks after Fig. 39 (case 12).

without infection in the presence of a serious destructive deep electrical burn.

Comment

It is hoped that these few cases have demonstrated some of the unique advantages of the cod liver oil method.

Cod liver oil is not, however, a panacea for all the evils of wound healing. Exuberant granulations often require trimming and the application of silver nitrate. At times a change from the oil to the use of Bettman's[76] oxyquinoline scarlet R or bismuth violet ointment may be temporarily beneficial. Hot wet saline or boric compresses may be very useful. The patient should always have the benefit of early skin grafting when necessary.

Of course general disease must be recognized and adequately treated. Syphilis, diabetes, circulatory disease, erysipelas, cellulitis, lymphangitis, pyocyaneus and gas infection require special treatment if cod liver oil therapy is to be effective. Hypoproteinemia must be prevented. The importance of proper diet can not be over-emphasized. Adequate cevitamic acid intake is essential for optimum wound healing. Above all anemia must be corrected by medication and repeated transfusions of whole blood. Consideration must be

given to all measures for improving the patient's general condition if best results are to be secured.

The only real disadvantage of cod liver oil therapy is the unpleasant fish oil odor more or less associated with the infrequently dressed wounds. This is reduced by the use of commercial ointments, and has not in my experience proved seriously disagreeable. No ill effects have been reported from hypervitaminosis. Irritation and maceration of the skin do not occur.

Summary and Conclusions

Cod liver oil is sterile and bactericidal. As a wound dressing it possesses a unique stimulating effect on granulation and epithelization. This results in rapid regeneration of tissue defects. The stimulating effect is probably chiefly due to its vitamin A and D content. The oil exerts also a beneficial generalized systemic effect, accelerates liquefaction of necrotic tissue, reduces the toxicity of pus, forms a protective non-irritating layer over the wound, requires infrequent dressings, is painless, and minimizes cicatrization.

Cod liver oil will not harm the most delicate tissues. It may be applied to the naked brain, the cornea, the exposed intestines, and all other tissues without irritation or fear of infection.

Cod liver oil therapy produces more rapid wound healing than other methods. It is so effective in cleaning up infected wounds and stimulating healing that it replaces Dakin's solution.

Cod liver oil offers an effective method of treatment applicable to the most severe major burns of all types, and superior in certain respects to other methods of local burn therapy, especially in third degree burns.

The first cure of chronic undermining burrowing ulcer with cod liver oil is reported as well as the first successful application of the oil to the naked intestines in two cases of complete rupture of an infected abdominal wound, with cure.

Various home-made and commercial cod liver oil ointments are discussed and compared. It is concluded that commercial ointments are superior to home-made preparations.

Cod liver oil ointment is recommended as a superlative method of local wound therapy applicable to both clean and infected wounds of all types and in the treatment of both new and old burns of major severity.

Note: Cases 1, 2, 4 and 9 are reproduced by courtesy of the North Carolina Medical Journal in which they were first reported.

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HORMONAL THERAPY OF FIBROMYOMAS OF THE UTERUS

ROBERT B. GREENBLATT, M. D.
and
EVERARD A. WILCOX, M. D.
Augusta

THE problem of bleeding from the myomatous uterus has been approached from various angles. We have taken the stand that bleeding in myoma cases is a co-existent phenomenon and not necessarily dependent upon the presence of the tumors. So firmly fixed is the idea of myoma and bleeding that it has become a habit of thought, and the average physician clings to this mental picture. The impression exists that with myoma there is always bleeding. Anyone with extensive experience knows this is not true. We find patients with massive tumors and no disturbance of their menstrual cycle. On the contrary we find patients with small tumors who bleed profusely. The purpose of this paper is to present in preliminary form our thesis that women with small fibroids and bleeding may be held in check by small doses of androgens administered orally or parenterally, and that women with massive fibroids and excessive bleeding may be promptly alleviated by subcutaneous implantation of pellets of testosterone propionate. The impression must not be gained, however, that surgery and other forms of therapy are thereby supplanted or discarded.

The condition of the endometrium in the myomatous uterus varies greatly. It may show little or no departure from normal, exhibiting the usual histologic sequence of cyclical changes with normal menses. On the other hand, the frequent finding of the hyperplastic endometrium of the non-ovulatory type suggested some time ago that bleeding might well be of dysfunctional origin. As a rule the endometrium overlying a myoma which projects into the cavity is extremely thin. The glands are far apart or absent altogether, leaving only a thin stroma stretched over the tumor. Elsewhere in the cavity, however, any thickness of the endometrium may be found, from thick hyperplastic type with cystic spaces to thin atrophic lining.

In a study of the mechanism of uterine bleeding by one of us (Greenblatt[1]), it was shown by the production of pseudo-menstrual

From the University of Georgia School of Medicine, Augusta.

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The pellets of testosterone propionate for implantation were supplied by Ciba Pharmaceutical Products, Inc.; the methyl testosterone for oral use was supplied by Schering Corporation. Both organizations were generous and most cooperative in furnishing testosterone propionate for parenteral use in the form of oreton (Schering) and perandren (Ciba).

bleeding in a castrate female what a minimal role the endometrium really plays. The role that it does play is only contributory and not of primary importance, for uterine bleeding may occur from a progestinal, a hyperplastic, a persistent estrogenic or an atrophic endometrium. In this particular case only the minutest amount of scrapings could be obtained after thorough curettage. The inability to obtain sufficient endometrium for study within one hour after onset of flow during a period following massive doses of estrogen and progestin therapy is sufficient evidence of the minimal role played by the endometrium. Sudden withdrawal of hormone therapy was followed on three occasions by a menstrual flow. This case study, because of proved insufficiency of the endometrium further emphasizes and confirms the recent observation of Bartelmez[2] that the myometrium and its vascular supply are dependent upon endocrine control. Menstruation is fundamentally a vascular phenomenon in which the endocrines play the underlying role, and it is doubtful whether the physical presence of a fibroid tumor has anything to do with bleeding.

How does the occurrence of bleeding seriously complicate the management of these cases? Since bleeding may occur in any type of myoma, something has to be done to stop it. Certain women with myomas should be operated upon but cannot because of anemia from continued severe bleeding. There are also the complications of tuberculosis, cardiovascular disease and fear of operation. Others not in the surgical group nevertheless bleed. If the bleeding could be stopped the tumor could be disregarded. Another with a small fibroid is near the menopause: if she can be kept from bleeding she might be tided over the change and the tumor allowed to regress. Still another is too young. Even myomectomy in these cases, if it be possible, is not the answer because the fundamental cause has not been attacked. Now, if these patients are treated by radium or radiation therapy their bleeding is stopped by an artificial menopause. If they be given transfusions, blood transfused finds its way out like the rest. We, therefore, recommend a method which may be used as a temporary stop-gap or as a permanent therapeutic measure.

Procedure: In this study chemically pure androgenic substances were employed and used in two ways: in the first series by injection as testosterone propionate or orally as methyl testosterone; and in the second series by pellet implantation of testosterone propionate beneath the fascia lata.

Action: These androgens are thought to inhibit the gonadotropic function of the anterior pituitary[3] and to temper the influence of es-

trogens[4]. Large doses have been used in the treatment of menorrhagia[5]. In addition to its salutary effect in inhibiting the development of ovarian follicles and thus limiting the production of estrogen, it may, if used in excessive doses, have the undesirable effect of producing masculinizing changes; e. g., in lowering the pitch of the voice, in causing hirsutism, or enlargement of the clitoris. Our studies have shown that satisfactory results can be obtained with smaller safe doses.

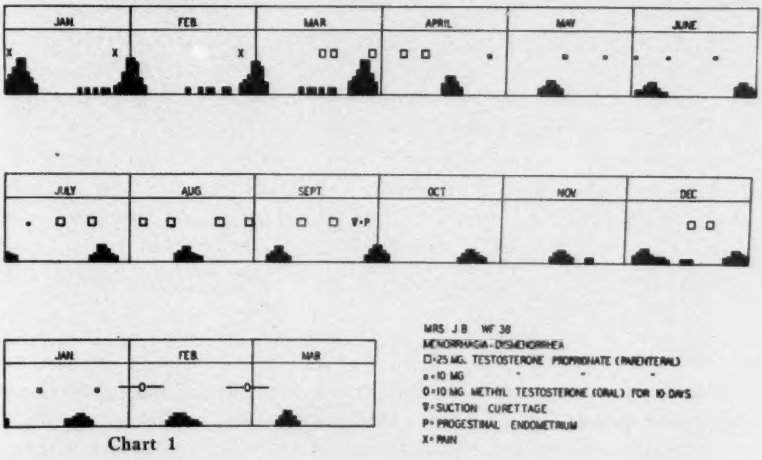


Chart 1

Group A

There were six patients in this group with small palpable uterine tumors. These tumors were 1 cm. in diameter, or less, submucous and usually multiple. These women had severe hypermenorrhea with or without dysmenorrhea, or lower abdominal pain and discomfort. Their ages ranged from 30 to 45 years. Synthetic crystalline androgenic substances were used by injection as testosterone propionate or orally as methyl testosterone and administered during the intermenstruum. Their menorrhagia was controlled, dysmenorrhea, lower abdominal pain and discomfort were eliminated, their sexual libido and feeling of well-being increased, and no virilizing symptoms developed in the dosages used in this series. The following case study was selected to illustrate a typical case:

Case 1: A nulliparous young married woman, aged 38, gave the following menstrual history: onset of mensis at 13; 23 to 28 day cycle; duration 4-5 days; normal amount and no dysmenorrhea. At the age of 23, dysmenorrhea and menorrhagia developed. She had had a variety of endocrine therapy. Three years previously dilatation and curettage had been done. The curettage was performed about the seventeenth day of the cycle and showed an imperfect progestinal endometrium. This procedure gave transient relief but after eight

months she began to bleed more than ever, usually profusely the first two days, having pains and cramps and also intermenstrual spotting. Chart 1 outlines the therapy and the results obtained.

It is important to point out in this case that her severe hypermenorrhea and intermenstrual bleeding have been relieved, dysmenorrhea has been eliminated and she has experienced a distinct increase in sexual libido and well being, without any evidence of virilizing symptoms. A suction curettage performed after therapy in September on the first day of her period, revealed a normal progestinal endometrium, demonstrating that testosterone propionate administered in small but effective doses does not interfere with ovulation.

Of the five other patients treated in this fashion, similarly good results were obtained in all but one, and in this one improvement was noted when therapy was adhered to closely. As soon as therapy was omitted or doses reduced excessive bleeding recurred. Androgenic substances have been used parenterally by Turpault[6] with moderate success. Greenhill and Freed[7] employed 850 mg. of testosterone propionate over a period of 53 days in a patient with fibroids and noted temporary shrinkage in the size of the tumor. Unfortunately, they had to discontinue further therapy because of the masculinization.

Group B

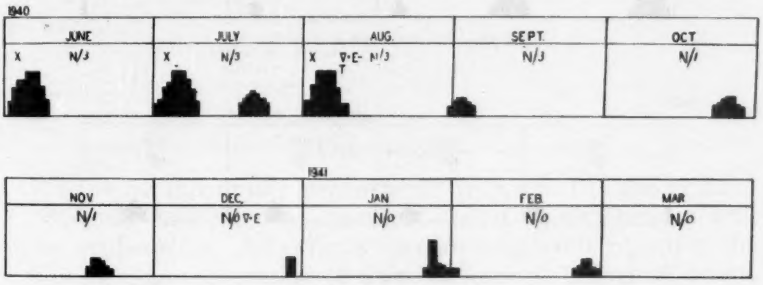
There were ten women in this group with fibroids ranging from rounded masses extending 3 cm. above the pubis to some at the level of the navel, and others reaching the costal border. All but one of these women suffered from either hypermenorrhea or severe menorrhagia to the extent that some were given several transfusions. Dysmenorrhea and pelvic discomfort was the rule. Treatment consisted of implanting the dose of testosterone propionate in pellet form at one time beneath the fascia lata of the right mid-thigh.

Technic: One and a half inch incision was made in the mid-lateral region of the thigh down to the fascia. The two sides of this longitudinal incision were held apart by rake retractors. The pellets were slipped through a small incision in the fascia lata to lie upon the muscle. The fascia was not sutured. Two figure-of-8 coaptation sutures were placed and the skin approximated with Michel clips. The pellets varied from 22 to 50 mg. in weight, and the size of the doses ranged from 25 to 145 mg.

This work was begun independently of and without knowledge of that of Loeser[8], reported in 1940, whose priority is acknowledged. Loeser made implants subcutaneously in the right and left hypogastric regions, putting them well apart and as deep as possible in the fat. He used very large doses, from 600 to 1650 mg.: some of these sloughed out. The general effects observed consisted of such an in-

crease in libido that he considered this to be an infallible aphrodisiac. It is noted, however, that invariably in his series signs of masculinization developed such as deepening of the voice, enlargement of the clitoris, and lanugo on the face. He claimed that these effects were all transitory and disappeared after therapy was discontinued.

We used in our own series of patients much smaller doses: because of the site of implantation the possibility of absorption was better. Sloughing or extrusion of the pellets did not occur in any of our patients. Then again, because of the smaller dose, no stigma of virilization was observed—although the desired results were obtained. The following case studies were selected to illustrate certain points as to dosage and results.



J.G. CF 41
MENORRHAGIA-DYSMENORRHEA
T- IMPLANTATION OF 25MGM TESTOSTERONE PROPRIONATE
▽- SUCTION CURETTAGE
E- ATROPHIC
E - ESTROGENIC
X - PAIN
N/- NOCTURIA, TIMES PER NIGHT

Chart 2

CASE 2:—J. G., a colored woman, aged 41, had one daughter 25 years old. Fifteen months before admission, her menstrual periods had begun to lengthen and to increase in amount. Intervals between bleeding spells soon shortened and she began to experience two bleeding attacks a month. Pain also began with the menorrhagia. She was exhausted when the flow was over. She reported to the University Hospital, May 27, 1940. The general physical examination was negative. The blood pressure was 148/74; hemoglobin was 6 Gm., r.b.c. count was 2,400,000. An orange-sized myoma was present in the fundus. This tumor could be felt above the pubis. On Aug. 12, 1940, one pellet of 25 mg. of testosterone propionate was implanted subfascially in the muscle of the right thigh. Endometrial biopsy at this time, after a long bout of bleeding, showed minute fragments of atrophic endometrium.

Bleeding stopped soon after implantation. There was only one mild recurrence of excessive bleeding. The period lasted 8 days, being profuse for the first two days (Jan. 1941). She is now stabilized with about a six day regular menstrual period. Suction curettage done on Dec. 19, 1940 (several

days before the expected menstrual period) revealed a follicular phase of endometrium (chart 2).

CASE 3:—L. H., a nulliparous, married Negro woman, aged 33, had massive uterine fibroids extending one inch above the navel, with severe bleeding and dysmenorrhea. Implantation of a 48 mg. pellet of testosterone propionate was performed. The mensis (July 31 to August 10) prior to this procedure was excessive and attended by much pelvic discomfort. Suction curettage performed in September on the first day of mensis revealed a progestinal endometrium. This woman became stabilized with periods, regular, duration 3-4 days and no pain. In the seven months of observation, the tumor has dimin-

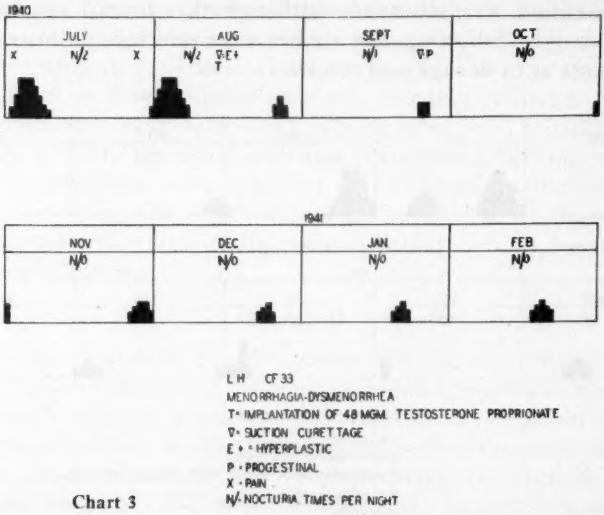


Chart 3

ished from a symmetrical mass one inch above the navel to two inches below it. Prior to this implantation she had been an invalid, and lost 7 or 8 work days a month being confined to bed on account of bleeding and pain. She now works throughout menstruation. Incidentally, this patient had nocturia three times a night before implantation of the pellet. This has now been completely overcome (chart 3).

CASE 4:—A. R., a well developed, obese, colored married woman had one child 25 years old. Pelvic examination revealed multiple small fibroids: a mass filled the pelvis but was not palpable above the pubis. On Feb. 27, 1937 she was admitted to the University Hospital because of severe bleeding of three weeks duration. The r.b.c. count was 2,750,000 and the hemoglobin was 50 per cent. On Dec. 12, 1940 she was again admitted to the University Hospital after having bled for three weeks. For four years she had been bleeding 2-3 weeks with each period. The patient was extremely anemic. The r.b.c. count was 1,750,000 and hemoglobin was 2 5 Gm. She was given a transfusion of 450 c.c. of citrated blood. On December 12, a curettage was performed and a cervical polyp was also removed. Curettings revealed a progestional endometrium. Two pellets of testosterone propionate totalling 100 mg. were implanted into the thigh muscle. Our observations since then reveal that libido has increased, the voice is stronger, the abdominal discomfort is much reduced

and her sense of well being has increased. Suction curettage done two days before the January mensis revealed a progestional endomentrium. Up to the time of writing of this paper this patient has been free from bleeding for the past forty days. Suction curettage performed late in February revealed a hypoestrogenic endometrium. This may be significant in indicating the effective action of the implanted pellets (chart 4).

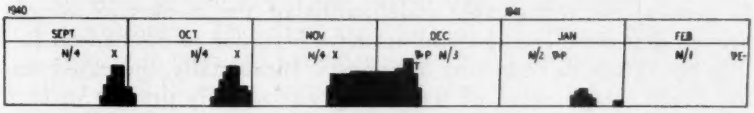


Chart 4

Discussion

The above three cases were selected from the 10 cases at hand to show the markedly and consistently good results obtained with pellet implantation. All patients were investigated in regard to the following points at weekly to monthly intervals: Vaginal smear, vaginal *p*H, voice changes, hirsutes, size of clitoris, breasts, sexual libido, menses, dysmenorrhea, pelvic discomfort, urinary disturbance, blood chemistry, size of tumor, weight of patient, blood pressure, endometrial biopsies, hemoglobin, blood count. These will be reported in further detail elsewhere.

Summary

Bleeding from the myomatous uterus is not due to the tumors per se but is rather a sequence of the associated endocrine imbalance. Testosterone propionate in small amounts (20-75 mg. per month) administered subcutaneously in divided doses proved capable of controlling the bleeding in a series of women with small fibromyomas of the uterus. Methyl testosterone administered orally in doses of 10 mg. per day for 10 or 15 days during the intermenstruum was capable of controlling the bleeding in the same patients. The therapeutic results, however, were not permanent and recurrences followed several months after cessation of therapy. It appeared, however, that the growth of the tumors was held in abeyance.

Pellets of testosterone propionate in amounts of 25 to 145 mg. were implanted (only once in each instance) upon the thigh muscles of patients with massive fibromyomas who experienced excessive

bleeding, which varied from hypermenorrhea to menorrhagia. All were promptly relieved of pelvic discomfort, excessive bleeding, and the dysmenorrhea that frequently attended the onset of bleeding. The size of the tumors seemed influenced in that each patient volunteered the information that the tumor appeared to her to be smaller. Other discomforts as nocturia were frequently alleviated. In general the remarkable stabilization of the menses to normal proved that the bleeding could not have been due to mechanical factors but rather to endocrine imbalance. Incidentally, increased sexual libido, and a sense of well being was notably present in each patient after pellet implantation. The patients have been followed from three to nine months. Implant scars have remained uniformly smooth, soft and without palpable deep induration.

The implantation of pellets of testosterone propionate for the alleviation of the symptoms that usually attend fibromyomas of the uterus is recommended in those cases where surgery is for some reason or other not feasible or desirable. The administration of male sex hormone in the form of chemically pure androgenic substance to female patients by this method was not attended by stigmas of masculinization in any of the patients.

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THE DIAGNOSIS AND TREATMENT OF ECTOPIC PREGNANCY

FREDERICK H. FALLS, M. S., M. D.
Chicago

THE subject of ectopic pregnancy holds interest for the general surgeon as well as for the obstetrician, gynecologist and general practitioner. The classical picture of the clinical phenomena associated with ruptured ectopic pregnancy is, I am sure, well known to all. I shall therefore spend no time describing this phase of the subject, but rather concentrate on the essential pathology of the various types of ectopic pregnancy, their diagnosis and treatment.

The reason why ectopic pregnancy should occupy our attention is the fact that it is one of the important causes of maternal death[1], ranking ninth in the United States, 437 cases, and eleventh in Illinois, 29 cases, in 1938.

Any analysis of the deaths from ectopic pregnancy reveals in most fatal cases mistakes in management which may have contributed significantly to the death of the patient, and which could have been avoided in great part if a proper evaluation of the clinical signs and symptoms had been made and prompt action taken.

The pathology and clinical course of ectopic pregnancy depends for the most part on the location of the site of implantation of the ovum. A proper interpretation of the clinical signs and symptoms in a given case is essential and must be based on knowledge of the pathology present, to permit the clinician to make an accurate diagnosis and to base a rational therapy thereon. Indeed a careful history and evaluation of the clinical findings will permit the accurate location of the position of the gestation sac in a large proportion of the cases. This may be of the greatest importance in a given case since it may lead the surgeon either to operate immediately, even in the face of certain unfavorable circumstances, or it may allow more leisurely and thorough preparation of the patient for operation. Procrastination in the former group of patients is absolutely indefensible.

In considering the etiologic factors I would stress the importance of previous pelvic infection as evidenced by history or the presence of pelvic adhesions, chronic cervicitis, uterine displacement and inflammation of Bartholin's and Skene's glands.

From the Department of Obstetrics and Gynecology, University of Illinois College of Medicine.

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Associated with this may well be noted a history of easy impregnation with the first conception followed by sterility for several years immediately preceding the ectopic pregnancy (one child sterility).

The presence or history of uterine fibroids is a point in favor of ectopic pregancy, since we have found the two conditions more commonly associated than could be explained by mere coincidence.

A history of a previous ectopic pregnancy in a given patient should be considered an important straw pointing in the direction of a second ectopic pregnancy, especially if the patient herself declares that she feels as she did during her previous ectopic pregnancy.

The history of a previous operative removal of one tube and the opposite ovum causing as it must an external migration of the ovum is in our experience so rare that it needs very little consideration.

The different symptoms produced by various types of ectopic pregnancy are so inconstant that in many instances it is difficult to realize that two patients showing most diverse signs and symptoms may both have ectopic pregnancy. This communication will be largely devoted to the elucidation of this phase of the subject.

The unruptured ectopic pregnancy wherever its location is rarely diagnosed before operation although under certain circumstances its presence may be strongly suspected. Pain is rarely severe. It is usually colicky and localized to one side. Irregular menstrual history, and palpation of a tender growing mass in the adnexal region make the diagnosis sufficiently probable to warrant investigation by laparotomy or colpotomy. Recently the peritoneoscope has been used more frequently for diagnostic purposes. It seems to me to have little advantage over other methods and under certain circumstances of adhesions and malposition of the tubes an ectopic pregnancy might be overlooked by this procedure. The Friedman modification of the Aschheim-Zondek test may be of some value in these cases as well as the Falls-Freda[2] skin reaction to be described later.

The *isthmic* type rarely develops for more than six or eight weeks before the symptoms manifest themselves. The usual outcome is rupture. First, because of the limited distensibility of the tube at this point, and secondly because abortion either into the interstitial or ampullary portion of the tube is anatomically practically impossible. The speeed with which the symptoms develop in this group of cases and the severity of the shock is of the greatest significance. In the great majority of cases very few symptoms precede the rupture and the diagnosis is frequently difficult, but not impossible.

Bimanual examination in a thin patient who relaxes well may reveal a tender thickening of the tube not far from the cornu of the

uterus. However, in a woman with a normal or fat abdominal wall it may be impossible to feel the enlargement of the tube. Following rupture the dramatic picture of internal hemorrhage unfolds itself rapidly as a rule. Sharp pain, fainting, bladder and rectal irritability, rapid compressible pulse, pallor and shock are noted in rapid succession. If not operated upon immediately, many of these patients die without recovering from the initial shock. If spontaneous recovery does occur it is often associated with profound prostration. Jaundice developing after a few days is due to absorption of blood from the abdominal cavity, and it may also produce distinct evidence of serious peritoneal irritation, such as rebound tenderness

Fig. 1. *Isthmic.* Rupture of isthmic ectopic at sixth week. Tubal abortion in either direction obviously impossible.

and vomiting. A temperature of 100 to 102 degrees Fahrenheit may be present and accompanied by a leukocytosis ranging from 12,000 to 25,000. At the same time the red blood cell count drops to two to three million per cubic millimeter and the hemoglobin to between 20 and 60 per cent. Usually there is an interval of a few hours before the dilution of the blood by the body fluids reveals the true degree of anemia. Diagnostic puncture of the culdesac practically always yields relatively fresh free blood in goodly quantity, even in cases where no hematoma may be felt.

Occasionally an ectopic pregnancy of the isthmic type ruptures between the leaves of the broad ligament. In such a case the hemorrhage is not quite so rapid and extensive. Shock is less marked and usually there is absence of rebound tenderness in the abdomen. The broad ligament hematoma that forms, presents a unilateral mass

which can be felt abdominally even in women with a moderately thick abdominal wall. On vaginal examination the uterus may be felt displaced laterally to the opposite side by the tender mass which obscures its outline on the side of the affected tube. On puncture of the culdesac of Douglas in the midline no free blood will be obtained, but puncture of the lateral mass will reveal clotted blood.

The *ampullary* type on the other hand is usually quite different in its manifestations. The distensibility of the tube wall at this point is much greater than it is in the isthmic portion. As a result pregnancy can advance to the third month or longer before the limits of expansion of the tube are reached at which time one of two outcomes is possible. More commonly a tubal abortion due to rupture of the decidua capsularis occurs during which the product of conception is extruded into the abdominal cavity usually without serious intra-abdominal bleeding. A moderate blood loss occurs as a rule, collects in the culdesac of Douglas and clots, forming a hematocele of varying size. There is often crampy pain and peritoneal irritation, some shock, pallor and rapid pulse, but on the whole the symptoms are often vague and misleading. The pulse is not so rapid and there may be little shock. Moderate rebound tenderness, slight fever and leukocytosis may be present. The red count and hemoglobin are only moderately reduced. These symptoms may improve or persist for a few days and then because of renewed bleeding become much worse with more pain, tenderness and cramps, and the patients develop the typical signs and symptoms of ruptured ectopic pregnancy.

If the tubal pregnancy is located slightly nearer the uterus, rupture may occur in the ampullary type with or without the extrusion of the fetus, causing as a rule more shock and symptoms of hemorrhage than when a tubal abortion occurs. Very rarely a sac of this type of ectopic may expand to contain a fetus almost full term size. When an abortion of an ectopic pregnancy occurs there is frequently a loosening of the decidual membrane of the uterus which may be extruded as a strip of skin-like membrane or in some cases as a partial or complete decidual cast. Microscopically, the examination of this tissue reveals the typical polyhedral cells with large clear staining nuclei and vacuolated cytoplasm. No chorionic villi can be seen in prepared microscopic curettage specimens.

It must be remembered however, that in very rare instances an intrauterine and tubal ectopic pregnancy can coexist. This is particularly dangerous because the extrusion of the uterine fetus and placental elements with considerable apparent blood loss at the time of the tubal rupture or abortion may lead to the erroneous impression that the symptoms caused by the ruptured tubal pregnancy are due

to an infected abortion. If such a case is treated medically it may result in a fatal intra-abdominal hemorrhage.

The hypertrophy of the uterus that is said to accompany ectopic pregnancy is not always present and one should not be surprised to find the uterus in some of these cases normal in size or even slightly smaller.

We have not been able to confirm the frequency of Cullen's[3] sign (a bluish discoloration around the umbilicus seen in cases with free blood in the peritoneal cavity).

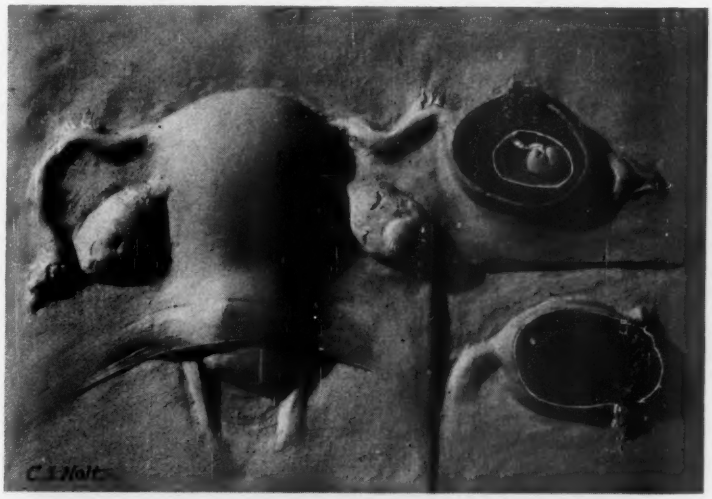

Fig. 2. *Ampullary.* Ruptured ampullary. Insert shows possibility of tubal abortion which is most frequent form of termination.

The *ovarian ectopic* pregnancy is such a rare form that no one writer has seen a sufficient number of cases to make a clear statement based on personal experience. It is probable however that this form of pregnancy is much more common than is generally believed. The reason for this belief is that when bleeding ovaries are found at operation they are interpreted in most instances as ruptured ovarian follicles. Careful gross and microscopic examination for evidence of ovarian pregnancy previously would often reveal their true nature. In general these pregnancies do not develop very far. Rupture occurs about the sixth to eighth week. The hemorrhage is usually somewhat more severe than in the ampullary type.

On bimanual examination the unruptured sac is felt as a cystic ovary rather than a dilated tube, although the distinction can rarely be made except in very thin patients who are easy to examine. The

clinical picture of shock and concealed hemorrhage with rebound tenderness, anemia and the finding of relatively fresh blood by colpocentesis are quite significant. Even when the abdomen is open the gross appearance of the ovary simul es exactly a ruptured ovarian follicle. The Aschheim-Zondek test if positive would help to distinguish this condition from the forms of ovarian cyst and hydrosalpingitis. A twisted ovarian cyst might simulate an ovarian ectopic pregnancy quite closely. In our experience the ovarian mass is larger as a rule before rupture. There is no history of missed

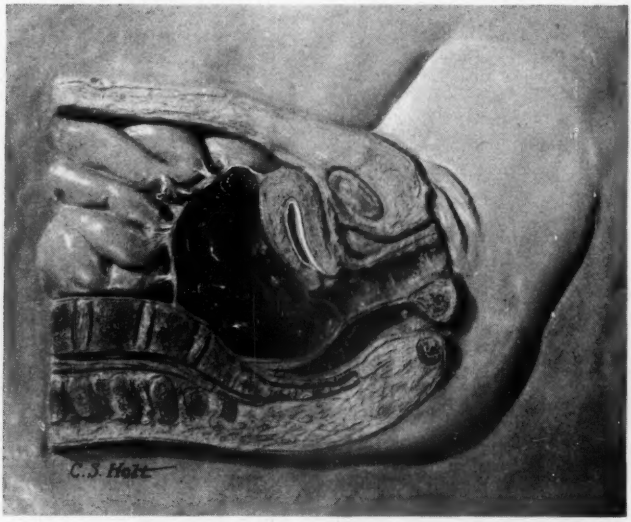

Fig. 3. *Hematocele.* Displacement of intestines by hematocele. Bulging posterior fornix makes colpocentesis simple. If infected, easily drained by colpotomy.

menstrual periods. The Aschheim-Zondek test is negative and the presumptive signs of pregnancy are not found.

Interstitial pregnancy—One of the most interesting, rare and confusing types of ectopic pregnancy is the interstitial ectopic. In such cases the fertilized ovum embeds and develops in that part of the tube that penetrates the wall of the uterus. The support given to the tube wall by the surrounding uterine muscle permits of much more distention than can be expected to occur in other parts of the tube. The embryo gets a good blood supply and develops at about the normal rate gradually distending the horn of the uterus in which it is located and displacing the body of the uterus to the opposite side. The pregnancy progresses to the size of four to five lunar

months or more before rupture takes place. The patient frequently feels the baby move and heart tones may be heard on prenatal examination. It is the presence of these positive signs of pregnancy and the length of time the woman has been pregnant that tends to exclude ectopic pregnancy from consideration in the minds of many

Fig. 4. *Interstitial.* The advanced development of the fetus is shown and the destruction of the uterine cornua when rupture occurs is obvious.

medical attendants. The diagnosis of uterine fibroids associated with uterine pregnancy is often made because of the irregularity of the uterine contour.

Symptoms present after the rupture are as a rule characteristic. Shock is extreme, usually associated with fainting and prolonged prostration. If the patient survives the initial shock, jaundice develops after a few days and may be deep. Fetal movement and fetal heart tones disappear. No cases of secondary abdominal pregnancy following ruptured interstitial have been reported.

On bimanual examination the unilateral increase in size of the uterus is significant. At operation after rupture the most characteristic picture presents itself. The mother is in profound shock and markedly anemic. On opening the abdomen, marked intra-abdominal hemorrhage is encountered. The uterus is enlarged, pushed to one side and on examining the fundus a crater is found involving its whole side. The placenta may or may not be detached from the cavity and the fetus is usually found displaced upward. In one of my cases[4] operated upon three weeks after rupture the fetus 25 cm. long was in an abscess cavity under the spleen. In another case it was found under the liver about ten days after rupture. The height of the fundus at the time of rupture and the forceful intrusion of the fetus probably accounts for its high position in the abdomen noted at operation or by palpation or x-ray. In cases that have not ruptured until late in pregnancy the fetal parts may be felt unusually clearly through the abdominal wall. The majority of these cases tend to rupture about the fifth month. In patients presenting a typical history of rupture the diagnosis may be in part confirmed by abdominal or vaginal paracentesis, for if fresh blood is obtained it is quite probable that ectopic pregnancy is the cause. This type of ectopic pregnancy is rare. There have been about one hundred of these reported in the literature. Before rupture they may be confused with pregnancy in the arcuate[5] type of bicornuate uterus. In these cases there is also an asymmetry of the uterine body which as a rule becomes less marked as pregnancy advances. The interstitial ectopic pregnancy seems to show more asymmetry as the pregnancy becomes older. There is more pain and irritation with the ectopic pregnancy. When a multipara with a uterus arcuatus presents herself, the history of the previous pregnancies and labors may give some clue to the anomaly. A fibroid uterus may present a very similar picture. The physical examination usually reveals several fibroids of the uterus and previous examination or history may have revealed the fact that fibroids were present in the uterus before the start of the pregnancy. However, it must not be forgotten that fibroids and an interstitial ectopic pregnancy may coexist in the same uterus.

Abdominal pregnancy—Although exceedingly rare the evidence seems to show that there have been a few primary abdominal pregnancies. The great majority of these cases are usually secondary to abortion or rupture of a tubal pregnancy and usually develop in the abdomen through attachments made by the placenta with whatever organs of the pelvis it comes in contact after it has been expelled from the fimbriated end of the tube (abortion) or much less commonly through a rent in the tube wall, either in the isthmic or ampullary region (rupture).

The abortion episode usually occurs about the second month of pregnancy. It is accompanied by more or less severe pains in the lower abdomen. There may be some evidence of shock and internal hemorrhage. The patient recovers from this in a few days and may feel normal for a period of a few months when she begins to have lower abdominal pain and discomfort especially on movements of the fetus. There may be considerable disturbance of the bowel function, and even moderate intestinal obstruction symptoms, with nausea and vomiting. The most common site for the development

Fig. 5. ***Secondary Abdominal.*** **Fetus usually is found in culdesac. Felt very clearly on rectovaginal examination. Movements cause pain.**

of the fetal sac is in the culdesac of Douglas. The uterus is displaced forward and upward and can be felt just posterior to the symphysis pubis when the bladder is emptied by catheterization. Fetal small parts and fetal movements may be felt quite distinctly through the posterior vaginal or anterior rectal wall on rectovaginal bimanual examination.

The most significant pathology in connection with these cases is the placental attachment which may be the outside of the uterus, the broad ligament, the pelvic wall, the bowel or omentum. The trophoblastic cells of the chorionic villi invade the tissues and open up blood vessels. These tissues unlike the uterine wall have no contractile power and hence have no means of closing the blood vessels when the placenta is detached at operation. As a result,

furious and uncontrollable hemorrhage frequently takes place when attempts are made to remove the placenta in such cases. If the fetus has died sometime before operation the removal of the placenta is much safer because the blood sinuses have become thrombosed.

Twin pregnancy may occur in ectopic pregnancy and may be a confusing factor in the diagnosis under certain circumstances. For example a twin pregnancy with one fetus located in the uterus and one in the tube may lead to the erroneous diagnosis of abortion of a uterine pregnancy as an explanation of the clinical symptoms presented. The expulsion of a fetus from the uterus and the appearance of chorionic villi in decidual particles removed from the uterus by diagnostic curettage confirm the clinical impression. The pelvic inflammatory symptoms under the circumstances are misinterpreted as being due to an infection of the aborting uterus and not to the intra-abdominal hemorrhage from the ectopic pregnancy. Valuable time may be lost and the patient may even die of shock and hemorrhage before the correct diagnosis is made. Paracentesis of the culdesac in suspected cases is about the only means of differential diagnosis, although a careful evaluation of the sequence of events in the history together with the mode of onset, fainting, rapid development of anemia out of proportion to the amount of visible hemorrhage, assist in making the diagnosis.

Another form of twin ectopic pregnancy fortunately very rare, is twin tubal pregnancy. The gestation sacs may be at different points in the two tubes, and as a rule one tube ruptures or aborts sometime before the other. The greatest danger connected with this complication is that the surgeon operating as he sometimes does with the patient anemic and in shock, with poor visibility due to the amount of intra-abdominal hemorrhage, will find the bleeding ectopic pregnancy on one side, elevate the tube and excise it and then close the abdomen without having inspected the opposite tube. Subsequent rupture of this tube may require reoperation within a month or six weeks. Very rarely there may be a twin pregnancy in one or the other tube. We have a gross specimen of a tubal twin in the ampullary portion of the tube and also a twin interstitial ectopic pregnancy.

Lithopedion: Very rarely an abdominal pregnancy may develop to within a few weeks of term and the fetus dies. It then becomes a foreign body which appears as a tumor which neither grows larger or smaller. Adhesions form around it and vague disturbances may be noticed, but as a rule very little pain. Many women have carried these masses for years and have gone through subsequent pregnancy and labor without inconvenience. The fetus frequently becomes en-

crusted with lime salts and is then called a lithopedion. The x-ray picture of the mass will show the fetal skeleton in part at least. As soon as the condition is diagnosed removal is indicated. Adhesions to omentum and intestines may complicate the removal of these fetuses and require painstaking dissection and careful peritonealization of raw surfaces left after removal of the sac to reduce the danger of subsequent intestinal obstruction.

Fig. 6. *Uterine Twin.* Rupture of the tube frequently causes uterine abortion. Abdominal symptoms may be considered evidence of infection resulting in surgical procrastination.

Diagnostic Procedures

Colpocentesis or puncture through the posterior fornix into the culdesac of Douglas is a very valuable procedure and one that can be carried out with little or no danger of injury to intra-abdominal structures if proper precautions are taken in its execution. Certain conditions should be fulfilled before it should be attempted.

1. There should be a mass in the culdesac sufficiently definite to indicate the direction of the diagnostic puncture.

2. The aspirating needle must be of sufficiently large bore to permit the passage of slightly clotted blood.

3. The vagina should be very carefully prepared as for a vaginal hysterectomy to avoid the possibility of carrying infection into the hematocele.

4. The needle should penetrate only as far as the hematocele and as soon as old blood is obtained no further exploration should be attempted.

5. Even a small amount of liquid or clotted old blood should be interpreted as being sufficient evidence of ectopic pregnancy to indicate exploratory laparotomy even in the absence of other evidence of ruptured ectopic pregnancy.

In certain cases of fibroid uterus it will be impossible to reach the culdesac, as is also the case in some women who have retroverted uteri and prolapsed adherent tubes and ovaries. In such cases however the tumor or uterine displacement are obvious on physical examination.

When an infected hematoma is encountered it is best to drain the same by colpotomy as the danger from fresh hemorrhage in these cases is very remote. A "T" tube is placed in the cavity for forty-eight hours and replaced daily by a straight tube until the cavity closes. The residuum may be removed later if indicated by symptoms.

A broad ligament hematoma may be located much higher in the pelvis and more laterally, and may be therefore more difficult to reach with the diagnostic puncture. In such cases it is better to forego this diagnostic procedure and depend on other signs and symptoms to make the diagnosis.

The use of x-ray in the diagnosis of ectopic pregnancy is reserved for those cases in which the pregnancy has advanced to four months or more. This practically limits it to the interstitial and abdominal pregnancies. In the former type we have what we think to be a unique picture of a 42 cm. fetus weighing 5½ pounds. The pregnancy had ruptured extruding the fetus up under the liver. We have no pictures of unruptured pregnancies of this type but see no reason why they should not be obtained and would hazard a guess that the position of the fetus with relation to the cervix might make the diagnosis quite probable. In abdominal pregnancy when the diagnosis is strongly suspected a picture after lipiodol injection of the uterus gives striking evidence of the position of the pregnancy.

In cases presenting lithopedion formation x-ray makes the diagnosis of the nature of the tumor with certainty.

The Aschheim-Zondek[6] test is valuable in 75 per cent of the cases in the series that have been run. The disadvantage of course is the necessity of waiting forty-eight hours after injecting the test animal before reading the test.

Recently we have developed a skin reaction for pregnancy which we believe will be of great help in the diagnosis of ectopic pregnancy. The test depends upon the fact that the breast after puberty apparently sensitizes males and females to colostrum. If an individual becomes pregnant the resultant increased production of colostrum immunizes them against colostrum. If therefore one injects colos-

trum under the skin of a pregnant person no reaction occurs, if the individual is not pregnant a marked increase in the size of the wheal produced by the injection occurs and a marked halo of surrounding redness which lasts for two to three hours is seen. The advantage of this test is that it can be read in thirty minutes after injection. In twenty-two patients with ectopic pregnancy tested so far, and proved by operation, it was correct in 85 per cent.

Treatment

Based on a consideration of these anatomic facts it will be seen that ectopic pregnancy is a complex condition not a simple one, and that the management of a given case depends upon the type of ectopic present and the stage of the pregnancy at which the diagnosis is made.

The isthmic ectopic whether ruptured or unruptured is always an emergency and no delay in operating on the case is justified if proper facilities are available.

The patient should be hospitalized just as soon as the diagnosis is suspected. She should have a blood examination including typing and be crossmatched with suitable donors, and in cases where symptoms of blood loss are present the blood should be drawn and kept in the icebox if not used immediately. Vaginal examination should be done very gently and only a few should be made to avoid the risk of causing fresh hemorrhage. For the same reason they should be postponed until the patient is in the operating room prepared for operation so that if fresh hemorrhage occurs it will not deplete the patient too much before the blood supply to the tube can be tied off.

This group provides a large number of the dramatic and fatal episodes which can only be avoided by prompt and vigorous action on the part of the surgeon. In some of these cases the patient when first seen is in such a condition of shock from hemorrhage that the advisability of opening the abdomen may be seriously questioned because of the danger of contributing to the shock. However the alternative of allowing the hemorrhage to continue in the hope that a lowered blood pressure will bring it to a spontaneous termination is certainly not inviting. To obviate this difficulty we have advocated and performed salpingectomy vaginally under local anesthesia[7]. The technic is similar to that employed for the Watkins-Wertheim interposition operation, namely, an anterior colpotomy incision of the uterovesicle fold and turning the fundus of the uterus forward under the bladder. The tubes can be easily visualized especially the isthmic portion and the tube on the affected side removed. The perineum and broad ligaments are first injected with 1 per cent procaine hydrochloride and the cervix is infiltrated an-

teriorly and posteriorly as well. The whole procedure can be carried out in about twenty minutes with a minimum of shock. Multiparous patients lend themselves better to the procedure although it can be carried out in primiparas. In these cases an episiotomy may assist in the exposure. If the patient is unusually sensitive or nervous a basal anesthesia of scopolamine grain 1/150 and morphine grain 1/4 one hour before operation, repeating the scopolamine a half hour before operation, is indicated. As a rule however, these patients are in such a state of shock that no basal anesthesia is needed. For those cases in which the vaginal approach is contraindicated and for those surgeons who strongly prefer the abdominal route, local anesthesia may still be used with advantage with or without the above mentioned basal anesthesia.

The ampullary type of ectopic on the other hand usually gives considerable warning before a life-threatening hemorrhage occurs. Tenderness in a lower quadrant, spotting, a sizable mass in the tube, a gradually enlarging hematocele, all point to this type of ectopic. From the history the duration of the pregnancy may be seen to be considerably longer.

In these cases some delay is justified if the diagnosis is uncertain or conditions are unfavorable for operating, either due to complications on the part of the patient or to the lack of proper operative facilities. I am convinced that many of these cases which abort into the abdominal cavity terminate by absorption of the product of conception and recover without operation. This possibility however does not justify a policy of non-intervention in such cases when a competent operator and proper facilities are available. While they can be done vaginally, experience leads me to believe that they are better done abdominally because adhesions or other complicating lesions may be better handled.

The ovarian ectopic pregnancy is usually best operated upon as soon as the diagnosis or tentative diagnosis is made. It is best done abdominally since it may be difficult to free and deliver the ovary and sac vaginally. Since these practically never go on to the stage of viability of the fetus, operation should be undertaken as soon as the diagnosis is made or even strongly suspected, and also because rupture may be associated with very severe hemorrhage.

Interstitial ectopic pregnancy gives such equivocal signs and symptoms that it is not surprising that the condition is rarely diagnosed as an ectopic pregnancy before rupture. In the first place it usually advances to the stage when the positive signs of pregnancy are readily obtainable. There is very little discomfort until after rupture occurs. Menstruation usually is absent during the early months as in normal pregnancy. The most severe signs of shock and hemor-

rhage are present when rupture occurs. In the cases that I have seen, however, the uterus apparently had the power to contract and stop the bleeding spontaneously before the patient was exsanguinated. One patient went one week, and the other five weeks before operation. Nevertheless it is obvious that immediate operation is

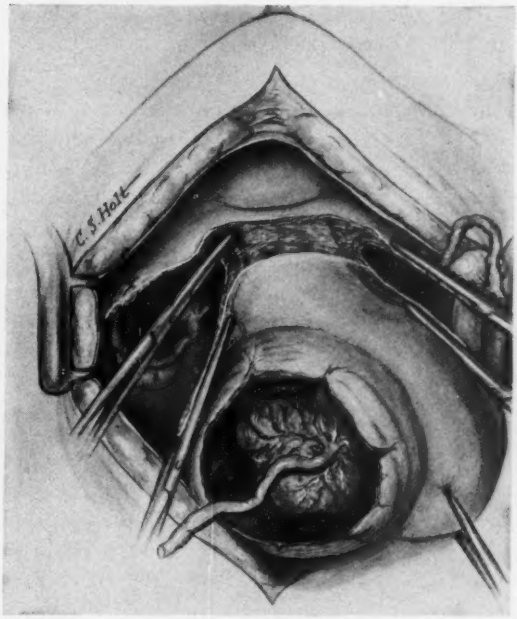

Fig. 7. Abdominal hysterectomy for ruptured interstitial ectopic.

the procedure of choice in these cases. In advanced pregnancies where the fetus is more than five months the fundus of the uterus is so badly damaged by the rupture that it seems best to do a supracervical hysterectomy. In earlier cases excision of the pregnant cornu with preservation of the uterus is indicated.

Abdominal pregnancy should not occur if the patient is carefully observed during pregnancy, because the abortion episode which leads to the implantation of the fetus and placenta in the abdomen should be treated by laparotomy and removal of the affected tube, fetus and blood clots. However, when such a patient not so handled presents herself with symptoms of abdominal pregnancy, immediate laparotomy is indicated as soon as the diagnosis is made unless the fetus is just on the border line of viability. Under these circumstances leaving it in the abdomen a few more weeks to give it a chance for life may be considered justifiable. In the early months the sac

and fetus can be removed without danger of serious hemorrhage. Later however (after the sixth month), the vascular attachments are apt to be so extensive that detachment results in severe hemorrhage. As a result most operators advise packing the sac with gauze after stitching its edges to the abdominal wall (marsupialization) and allowing it to come away piecemeal. Recently a series[8] of cases have been reported where the abdomen was closed leaving the placenta in situ with no bad after effects.[8]

A lithopedion should be removed by laparotomy as soon as the diagnosis is established providing the patient is a reasonably good surgical risk. The fact however that many women have carried such tumors for years without serious inconvenience indicates that conservative management of these cases is justifiable if there are reasonably sound contraindications to surgery.

In those cases in which blood loss is a serious factor steps should be taken to replace the same at the earliest possible time compatible with safety. To that end a patient with a diagnosis of probable ectopic pregnancy should be immediately typed and crossmatched with a suitable donor. Intravenous fluids should be started if the evidence of serious progressive blood loss is present even at the risk of raising the pressure and losing some of the transfused blood into the abdomen before the operation can be completed. If blood is not available, 10 per cent glucose in salt solution with or without acacia may be used advantageously. Especially in acute desperate cases where time is an important element I have opened the abdomen, mopped up the blood after excising the tube, rung out the laparotomy sponges into a pan, filtered out the clots through gauze and put the fluid blood back into the patient, mixing it with the glucose solution. I have had no untoward results from this procedure. I would however hesitate to use blood that had been in the abdomen for some time previous to operation, because of the danger that it might have become infected from the bowel. Pooled serum has also been used in these cases and while not as good as blood is probably better than glucose or salt solution.

There is a tendency on the part of some operators to do other operative procedures such as appendectomy, uterine suspension or myomectomy in connection with the operation for ectopic pregnancy. This is in my opinion bad surgical judgment in most cases. The mortality is thereby significantly increased and complications and morbidity greatly augmented.

Conclusions

1. Different types of ectopic pregnancies give the most diverse symptoms.

2. Colpocentesis should be employed freely in cases of doubtful diagnosis.

3. Patients with fulminating onset should be operated upon as soon as feasible. An isthmic type will usually be found if symptoms appear in the first six to eight weeks, or an interstitial type if in four to five months.

4. In cases showing severe shock, operate under local anesthesia either abdominally or vaginally.

5. When interstitial, abdominal and lithopedion varieties are suspected, use x-ray for diagnosis.

6. When the exigencies of the case permit, use Aschheim-Zondek and Falls-Freda reaction.

7. The opposite tube should always be inspected at operation when removing one tube for ectopic pregnancy.

8. Do not let the expulsion of a fetus and placenta from the uterus blind you to the possibility of a concomitant ectopic pregnancy.

9. Where the diagnosis of ectopic pregnancy is reasonably sure do not delay operation.

10. Blood replacement as rapidly as possible from a carefully crossmatched donor is important. Failing such a donor simple 5 per cent glucose in normal salt solution or acacia suspension is valuable.

11. Other unnecessary abdominal operative procedures should not be done at the time of operation for ectopic pregnancy.

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TREATMENT OF ACUTE FRACTURES OF THE NECK OF THE FEMUR

H. B. Boyd, M. D.
Memphis, Tenn.

IT IS the purpose of this paper to evaluate the treatment of fractures of the neck of the femur by means of the three-flanged nail originally introduced by Dr. Smith-Petersen of Boston. One hundred fifty patients with fractures of the neck of the femur have been treated in this manner by the staff of the Willis C. Campbell Clinic. Formerly, these fractures were treated by the Whitman method. The advantages of internal fixation were soon appreciated and, at the present time, all patients who are not moribund on admission are treated by internal fixation. In this study, all impacted fractures of the neck of the femur, fractures of the base of the neck, and trochanteric fractures have been excluded. Only true fractures of the neck of the femur with displacement have been included.

The advantages of internal fixation in the treatment of this fracture are many. The patient is not immobilized in a body cast, which allows free motion of all joints including the affected hip, thus preventing the stiffness of joints, especially the knee, following the removal of casts as previously seen. The patient's position may be changed as often as necessary, and he may be allowed to sit up in bed on the day of operation. This is most important in the prevention of hypostatic pneumonia and decubitus ulcers, particularly in elderly patients.

Indications for the Operation. It was formerly believed that such an operation should be reserved for the better operative risks. This was true with extensive operations, which included opening the hip joint and nailing the fracture under direct vision. With proper equipment and roentgenographic control, the nailing is accomplished without opening the hip joint and may be done under local anesthesia. With these refinements in technic, the poor operative risk can be safely subjected to surgery. These patients are in greater need of, and benefit more by, the procedure. Many patients whose physical condition would not permit long immobilization in a cast will do nicely following the insertion of the three-flanged nail. It is our feeling now that, unless the patient is moribund on admission, he is entitled to the advantages of the operation. The general condition of many patients improves following this procedure.

From the Willis C. Campbell Clinic.

Optimal Time for Operation. There is a division of opinion as to when the operation should be performed. Some writers advise immediate operation; others prefer to treat the patients in traction or splints for a few days, to prepare them for surgery. We are of the opinion that the operation should be performed as soon as feasible following the fracture. These elderly patients are never comfortable in traction or splints. Every movement of the hip is painful so, in self defense, they lie quietly on their backs, which invites hypostatic pneumonia and decubitus ulcers. The pain experienced in attempting to move, as in getting on or off the bed pan, only aggravates an already bad situation. Under such conditions, one should not expect the patient's general condition to improve.

Fig. 1. Typical acute fracture of the neck of the femur (case 1).

Type of Operation Employed. Arthrotomy of the hip joint followed by nailing under direct vision may be justified in patients who are good surgical risks. We feel that this is unnecessary, and it should not be done in patients who are in poor general condition.

As explained above, the latter needs the operation more. We have abandoned the open arthrotomy for nailing under roentgenographic control. The anesthetic is suited to the patient's general condition, gas and oxygen, spinal, sodium pentothal or local, as the case may be. In poor surgical risks, the last is used. A spinal puncture needle is inserted into the hip joint, as much blood as possible is aspirated from the fracture site, and about 20 c.c. of 2 per cent procaine hy-

Fig. 2. Smith-Petersen nail in position 1 month postoperative (case 1).

drochloride is injected into the hip joint. The fracture is then reduced by manipulation, and roentgenograms taken in the anteroposterior and lateral views to verify the reduction. After routine surgical preparation, the skin and deep tissues overlying the lateral surface of the upper four or five inches of the shaft of the femur are injected with 1 per cent procaine hydrochloride. A short longitudinal incision is made down to the bone. A guide wire is then inserted through the shaft and neck of the femur, and into its head. Roentgenograms are then made in anteroposterior and lateral views. If the guide wire is in the proper location, the nail is inserted. If

not, the wires are adjusted and further roentgenograms taken until the proper location of the guide wire is obtained, both in the antero-posterior and lateral views. The nail is cannulated so that it can be passed over the wire and driven into place. Roentgenograms in both views are taken again to check the final position of the nail.

Postoperative Care. Following the operation a light cast may be applied to the foot and leg below the knee, into which is incor-

Fig. 3. Condition of the hip 3 years and 1 month postoperative. There is normal range of motion of the hip in all directions. Good joint space and no evidence of arthritic changes (case 1).

porated a twelve inch horizontal bar at right angles to the leg at the level of the ankle, to keep the hip slightly internally rotated and to prevent external rotation. Often no external fixation is needed, and a sand bag is placed along the lateral side of the foot and ankle to prevent external rotation. If indicated, the patient may be elevated on a back rest immediately following the operation.

The position of the patient is changed at least every three hours. In doing this, care should be taken not to adduct or externally ro-

tate the affected thigh; otherwise, the patient may sit up in bed or be turned on either side as desired. Routine nursing procedures to prevent bed sores are employed. The fluid intake and output are charted, and the intake kept up to the required amount to prevent dehydration.

We feel that, following the operation, bed rest is indicated for two months. During this time the patient may be gotten up in a wheel chair, if his general condition can be treated better by so doing. Then walking with crutches, but without weight-bearing, is started and continued for one month. At the end of the third postoperative month, partial weight bearing with crutches is instituted. Full weight-bearing should not be allowed until union is demonstrable in the roentgenograms. Many authors allow earlier weight bearing than that outlined above, stating that it promotes union. This is open to question, and premature weight-bearing on a poorly vascularized femoral head predisposes to arthritic changes and irregularities of the head of the femur.

Removal of the Nail. The nail should not be removed until solid bony union has occurred, unless it is giving difficulty or non-union is apparent and inevitable. After one is certain that solid bony union is present, there is no advantage in leaving the nail in place. It may be readily removed under local anesthesia. The minimum time for removal of the nail should be one year. If the nail is causing no difficulty and the patient objects to its removal, it may be left in place indefinitely. In such a case, the patient should be instructed to return for removal of the nail if it causes any difficulty.

Types of Fractures. Fractures of the neck of the femur have been clasified by Powell into three groups, based upon the location and direction of the fracture line, and the resultant shearing force. Impacted fractures with valgus and no shearing force constitute group I. Internal fixation is not imperative in this group, as union is the rule without it. The transverse fractures (group II) result in moderate shearing force; consequently, internal fixation is necessary to eliminate this force and to provide optimal conditions for revascularization of the head and bony union. In group III the fracture line passes obliquely through the neck, usually leaving a spike-like protrusion of bone on the inferior and lateral aspect of the proximal fragment—the so-called pear-shaped head. Theoretically and practically these fractures have the poorest prognosis. First, because they produce the maximum shearing force; second, they are often difficult to reduce; third, unless great care is taken the head tends to rotate when the nail is inserted.

In this paper, group I fractures have been excluded (impacted fractures), and only groups II and III have been considered. The percentage of the latter in our series is 12.5.

Age and Sex. In this series of cases, the patients range from 17 years to 90 years of age. Thirty-six per cent were in the seventh

Fig. 4. Anteroposterior and lateral views, showing Smith-Petersen nail in good position (case 2).

decade of life, 23 per cent in the eighth, 17 per cent in the sixth, 14 per cent in the ninth, and 10 per cent in the remaining decades. From this it is noted that, in 90 per cent of the patients, the fracture occurred between the ages of 50 and 90. Seventy-nine five-tenths per cent of the patients were females, and 20.5 were males. The preponderance of women may be due to their wider pelves, with a resulting tendency toward genu valgum. Elderly women tend to be less active than men, which may predispose to a more marked senile osteoporosis.

Mortality. In our private patients, the mortality has been 10.2 per cent, which includes deaths occurring within the first six months postoperative. The mortality for the first postoperative month was 5.7 per cent. When one considers that these are not selected cases, it is appreciated that the mortality is well within the expected limits for patients in the age group in which this fracture usually occurs.

Fig. 5. Appearance of the hip 2 years and 2 months following insertion of the nail. Solid bony union is present. The head of the femur has undergone aseptic necrosis, and definite arthritic changes are present. Arthritic changes occurred in 15.5 per cent of the patients that secured bony union. This patient represents an extreme degree of arthritis. In the majority of the patients, the arthritic changes are not so severe (case 2).

Also, contrary to common belief, the mortality is appreciably lower than in persons treated with the Whitman and other so-called conservative methods.

Union. For economic reasons, it is difficult to follow some patients. Others have been operated upon too recently to determine the end result. Fifty-five patients, however, have returned for study and roentgenographic examination after a sufficiently long postop-

erative period to determine bony union. Of these, 86.5 per cent have bony union, and 13.5 per cent result in non-union. These figures are to be compared with approximately 50 per cent bony union following the Whitman method, which was the best until internal fixation was adopted. As time passes, the percentage of bony union will probably increase slightly, as these figures include the early patients before the technic of the operation was as well standardized as it is at the present time.

Arthritic Changes. Following union at the fracture site, arthritis of the hip joint may develop. This complication was noted in 15.5 per cent of those patients in whom bony union was obtained. In these patients, arthritic changes were demonstrated in the hip joint by roentgenographic examination which were not present on the original films at the time of fracture. In most instances, arthritic changes were seen following union at the fracture site in the presence of aseptic necrosis of the head of the femur. As time passes, a larger percentage of arthritic changes will probably be reported following bony union, as it requires time, motion and weight-bearing to produce them. On the other hand, experience may help us to prevent arthritic changes. Aseptic necrosis renders the bone less suitable to withstand weight-bearing, and predisposes to this complication. In these patients it may be advantageous to postpone weight bearing until sufficient time has elapsed to permit adequate revascularization of the femoral head.

Conclusions

1. Fractures of the neck of the femur are best treated by internal fixation. Preferably by the insertion of a Smith-Peterson nail under roentgenographic control, as the operation can be done under local anesthesia when other anesthetics are contraindicated.

2. The patients are more comfortable and less prone to postoperative pneumonia and decubitus ulcers than in other methods.

3. Stiffness of joints, often seen in elderly patients after removal of body casts, is avoided.

4. The mortality is lower and the percentage of bony union higher than with any other method.

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Editor

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Associate Editor

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IS THE BASSINI OPERATION OBSOLETE?

The preparation of young men for military service during the First World War witnessed an enormous number of corrective surgical procedures, such as operations for hernia, hydrocele, varicocele, varicose veins and others. As a consequence master surgical minds were directed toward a review of these so-called simple problems, with marked improvement in ultimate results. For example, due to the forceful criticism of Bloodgood, operations for varicocele were ruled out of order, so that today such treatment is rarely deemed indicated. Other operations, once popular and frequently performed, such as Ebebohl's kidney suspension, and amputation of the scrotum by Valentine's clamp have fallen into the discard, as time and experience have proved them to be unnecessary. Now, as the organization of another greater army is begun, and operations for hernia will be done by the thousand, high authorities declare that Bassini's method, so commonly followed in 1917, should not be the procedure of choice in the majority of cases. Indeed, some writers, such as Zimmerman[1], believe that Bassini's method should be abandoned entirely. Direct inguinal hernia is not considered in this discussion, although preoperative differential diagnosis should be made, so that the patient is advised that this variety of hernia is more difficult to cure.

Many surgeons would be loath to give up a favorite operation of this kind which has been considered the first method in curing inguinal hernia since Bassini first described it fifty years ago. However, if more mature study shows that better results may be obtained by other means, sentiment and tradition should not be al-

lowed to prevent a change. It is difficult to determine what are the ultimate results in any operation for hernia. Many percentages of recurrence published by competent, conscientious men are at fault because it is impossible, in the practice of the average surgeon, to know the outcome of every case in a large series. As an example, in a small series, the writer recently sent a letter to 114 consecutive private patients who had had Bassini's operation for indirect hernia during the past twenty-five years, the most recent case in the series being one year old. Inquiry was made as to whether the patient was completely cured of his hernia, and fifty answers were received which showed 45 satisfactory results and 5 recurrences, or failure in 10 per cent.

What happened to the other sixty-four patients who did not answer the questionnaire? No doubt some of them did not receive the letter, or if they received it they paid no attention to it; or their recurrent hernias were repaired by another surgeon. In any event a patient whose operation was successful would be more apt to answer such a questionnaire than one whose hernia had recurred, so that the percentage of failures in this group would be more than 10 per cent. This is in keeping with the figures published by large clinics in which the percentage of recurrences range from 9 per cent to 27, 32 and even 40 and 50. The type of operation performed in these cases is not always stated, but many methods besides Bassini were followed, so that such a large number of failures could not be blamed entirely upon Bassini's operation.

The typical Bassini was done in every one of the 114 cases mentioned in the above series. If Bassini is not a good operation, if stitching muscle to fascia is not a correct surgical procedure, which is doomed to failure, why should *any* hernia operation using Bassini's technic be successful? This method no doubt has been followed more often than all other methods combined, and tens of thousands of patients could rise and declare that the Bassini operation cured their hernias.

The principal objection offered to the radical cure of indirect hernia as practiced by Eduard Bassini has been that the operation includes suture of the so-called conjoined tendon of the internal oblique and transversalis muscles (which is more a muscle than a tendon) to the shelving edge of the inguinal ligament (Poupart's), and that animal experimentation has shown that muscle sewn to fascia does not hold well, and tends to stretch and give way; in other words that like tissues must be united together. Eighteen years ago Seelig and Chouke[2] performed experiments which appeared to show that suturing muscle to fascia fails to give satisfactory results. It

is now claimed, however, that closing the inguinal canal by suture of muscle to the inguinal ligament is not necessary after all, since recurrence of the hernia does not take place through this area but through a weak internal abdominal ring. Therefore the most important step in this type of hernia is careful suture of the transversalis fascia to the inguinal ligament close to the internal ring.

Bassini's operation, as described by himself[3], provides for this important step. He did not suture the fascia to the ligament as a separate stitch, but advised the inclusion of the fascia with the muscles as they were sewn to the ligament. This, indeed, often is all that can be accomplished, because the transversalis fascia in this location is not always a definite tissue, and may be frail and identified with difficulty. If the fascia proves to be a thick, strong tissue it certainly should be united to the inguinal ligament in a separate layer. Bassini did suture the conjoined tendon to the inguinal ligament, but he referred to the former as the "triple musculo-aponeurotic layer," by which he meant the internal oblique and transversalis muscles and the "fascia verticalis Cooperi," a name which has disappeared from the anatomies.

Bassini does not mention high ligation of the hernial sac, and this is another step in the operation, formerly insistently advised, which today is not considered necessary. It would seem, however, that ligation above the neck of the sac in sound, normal peritoneal tissue would hold better than ligation in the thin, stretched tissue of the sac. Bassini transplanted the spermatic cord, and many authorities today think this is a needless and harmful procedure. Such technic, however, allows the inguinal canal to be closed more snugly, if this is necessary. Whether or not the cord or testicle is injured thereby could only be proved by a large collection of statistics, extending over a long period of time. In the small series quoted above no damage of this kind was recorded.

Bassini was able to follow for two years 241 of his first 339 cases, with failure in 52 instances, about 21 per cent. With the imperfectly developed aseptic technic of those days, such a record should be considered commendable. As a matter of fact, seven of his patients died, a result which could hardly be condoned today.

Altogether, Bassini's operation for indirect inguinal hernia is not obsolete, and should not be abandoned. When carried out carefully in every detail the results are good. What other method has stood such a long test, and what are the results by other methods? After all is said and done, perhaps it is not the method which produces the results, but the man who is practicing the method. The operation often is delegated to the novice in surgery, but no procedure

requires a better knowledge of anatomy, nor more thorough acquaintance with surgical principals, nor more painstaking, gentle technic. Results may depend upon the kind of tissues one is handling. If the hernia is old and large, and the tissues thin and stretched, firm unyielding union is difficult to obtain, whereas if the hernia is recent and small, and presents sound tissues, not damaged by long pressure by a truss, success is more liable to follow any operative method scrupulously done. Wearing a truss may be safer for a limited number of patients, but for the average young individual with a hernia there can be no question but that early operation is the treatment of choice.

FRANK K. BOLAND, M. D.

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GOITER ASSOCIATION ANNOUNCEMENT

The American Association for the Study of Goiter announces that its 1941 meeting will be held at the Hotel Statler in Boston, on May 12, 13 and 14, instead of the date originally announced.

PRESENTATION OF MEMORIAL GAVEL

T. C. Davison, M. D.
Atlanta

It is again our privilege to honor the memory of our departed colleague and leader, C. Jeff Miller. It would indeed be a waste of words for me to attempt to eulogize one who was so well known and whose works survive him.

This memorial service which we hold from year to year should be not for Dr. Miller alone, but for all of our departed colleagues including the late W. D. Haggard. The list will grow from year to year and in honoring their memory we honor ourselves.

Tonight I have the honor of presenting to the Congress a memorial gavel and it is fitting that it should be presented in this historic City of Richmond, at our first meeting in the great Mother State of Virginia. This gavel is made of dogwood. It bears a silver plate on which is inscribed that the wood from which it is made grew on the Georgia farm of the illustrious Dr. Crawford W. Long, who first used ether as an anesthetic in 1842. Dr. Long did not realize it but he was a pioneer in anesthesia, not only in the Southeast but throughout the entire world. Modern surgery today rests upon the tripod which represents the discoveries of Crawford W. Long, Joseph Lister and Louis Pasteur;—without these three discoveries, surgery would still be in the dark ages.

The dogwood from which this gavel is made is also significant, since there is a legend which goes back two thousand years, to the time when Jesus Christ our Savior was crucified. According to the legend the cross was made of dogwood and therefore a curse was placed on the dogwood tree, that in the future it should never again grow tall, strong and straight but rather that its body should be stunted, crooked, gnarled and knotty, its blossoms (which appear around Easter time) should be in the shape of a cross with a center resembling the crown of thorns which covered His bleeding brow, and in the margin of each petal of the blossom there should be a mark resembling the prints of the rusty nails which pierced His hands and feet.

Mr. President, it is my desire that at future annual Assemblies of this Congress, where surgeons meet from all parts of this great nation to learn new methods of healing the sick, this gavel when used to call the Congress to order, may be both a memorial to Dr. Crawford W. Long and a symbol of the lowly Nazarene who was called the Great Physician, who went about doing good, and who never preached without healing the sick, restoring sight to the blind, making the lame to walk and who said "Inasmuch as ye did it unto the least of these my brethren, ye did it unto me."

Presented at the Memorial Service of The Southeastern Surgical Congress, in Richmond, March 10, 1941.

BOOK REVIEWS

The Editors of THE SOUTHERN SURGEON *will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The Editors do not, however, agree to review all books that have been submitted without solicitation.*

THE MEDICAL REPORTS OF JOHN Y. BASSETT, M. D., THE ALABAMA STUDENT. With an Introduction by DANIEL C. ELKIN, M. D., Joseph B. Whitehead Professor of Surgery, Emory University School of Medicine, Emory University, Georgia. Price, $1.50. Springfield and Baltimore: Charles C Thomas, Publisher, 1940.

"The Alabama Student" lives again! Those who have enjoyed that most delightful biographical sketch by Osler will renew and increase their pleasure by reading "The Medical Reports of John Y. Bassett, M. D., The Alabama Student." Others not familiar with that essay will want to secure it after becoming acquainted with this new presentation of the life and writings of this interesting physician who was practicing in northern Alabama one hundred years ago.

Daniel C. Elkin, in a compact introduction, tells how the reports happened to be published and his comments about Erasmus Darwin Fenner, editor of the Southern Medical Reports are most interesting. The appendix consists of a letter written to Osler by Claudius H. Mastin, who relates further incidents in the life of his preceptor, John Y. Bassett.

The principal subject matter of this small book consists of two reports by Bassett. They show him to be an astute observer and wise philosopher as well as a thoughtful physician. Some local historical events are illustrated by case reports as are the various illnesses he discusses. His description of a victim of purpura as having the "appearance of Lucan's child bit by the Lybian serpent" is illustrative of other references which show the broadness of this pioneer's education.

While he depended largely upon calomel, quinine, and opium in massive doses he had definite ideas regarding the value of hydrotherapy. Of considerable interest are the clinical reports of three cases of chronic osteomyelitis treated surgically. Even more surprising is the medical economics survey of his own county.

Charles C Thomas has published this book in the usual attractive style we have learned to expect of him. The illustrations are well-chosen. "The Medical Reports of John Y. Bassett, M. D., The Alabama Student" is a "must" book for those interested in medical history and an ideal gift book for any physician.

J. DUFFY HANCOCK, M. D.

AGE MORPHOLOGY OF PRIMARY TUBERCLES. By HENRY C. SWEANY, M. D., Medical Director of Research, Municipal Tuberculosis Sanitarium, Chicago; and Research Associate, Department of Physiology, University of Chicago. 265 pages, with 73 illustrations. Price, $5. Springfield, Illinois, and Baltimore, Maryland: Charles C Thomas, Publisher, 1941.

Have you ever wondered how old a tubercle was? As much as we know about the morphology of tuberculous lesions, we pay little attention to the time element in them. Dr. Sweany's curiosity has stimulated him to a new and original theory which serves to advance the knowledge of this subject.

Biologic phenomena both physiologic and pathologic have a very important relation to time, as shown in normal growth, healing, and the course of measles, for instance. Is it not, then, reasonable that encapsulation and restoration of injured tissues should have a definite time curve? This is the theme of the monograph.

The author has studied a number of cases in which the time of infection was known, and has found that tubercles of the same age have a remarkable similarity, and that all have a definite sequence of maturation, degeneration, regeneration and metaplasia. Each phase has such a definite time that by pathologic study the age can be determined with accuracy within plus or minus 25 per cent.

The descriptions of the stages in development of the tubercle are excellent, and are one of the high spots of the book. An interesting series of cases is presented in which the time of contact was determined by post-mortem study, and the accuracy is surprising. Also, although the work concerns primary tubercles, it was found that reinfection lesions are similar in morphology and time relations.

The only practical application for clinical purposes is in the study of primary tubercles by x-ray during life, and the value here is limited. Only few of these lesions are visible, and only part of these show age changes. A prognostic point is that large and soft lesions are dangerous.

Dr. Sweany's presentation is good, and the evidence supporting his thesis is convincing. The book abounds in illustrations of x-rays and pathologic specimens. We predict that this scientific work will take a high place as a contribution to the study of tuberculosis.

LANDMARKS AND SURFACE MARKINGS OF THE HUMAN BODY. By L. BATHE RAWLING, M. B., B.Ch. (Cantab.) F.R.C.S., Consulting Surgeon to St. Bartholomew's Hospital. Eighth Edition (New Terminology). Price, $3. 98 pages, with 36 illustrations. New York: Paul B. Hoeber, Inc., Medical Book Department fo Harper & Brothers, 1940.

Many may wonder, and perhaps we do too, if it is necessary to have a separate book on landmarks and surface markings, for these are covered in all good textbooks of anatomy.

In this handbook however it may be easier to find data on surface markings than in the larger works. Though the illustrations are few, the descriptions are short and exact. The main change from previous editions is that the British Revision of B. N. A. Terminology has been adopted.